SERVICE MANUAL
& PARTS LIST

(without price)

ELECTRONIC KEYBOARD

VZ-1

JUNE 1988

VZ-1

CASIO®

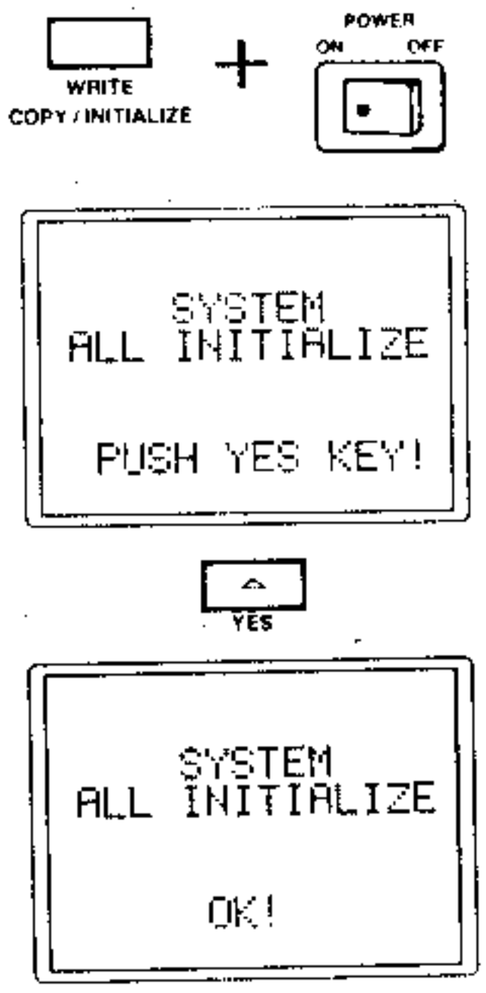
CAUTION:

When the connector ○ (from the lithium battery) is disconnected, all the sound data in the memory are cleared. When this happens, initialize the unit by the following procedures.

The VZ-1 can be "initialized" in a number of ways, allowing you to reset the entire keyboard to its initial factory settings or initialize only the data of a specific MODE or FUNCTION, for example. The following describes the various VZ-1 initializing procedures.

SYSTEM ALL INITIALIZE

To initialize **all VZ-1** internal operation memory, voice and effect data to factory preset values, hold down the WRITE key and turn VZ-1 power ON. Respond to the YES? prompt by pressing the YES key. All internal data is reset to its original state.



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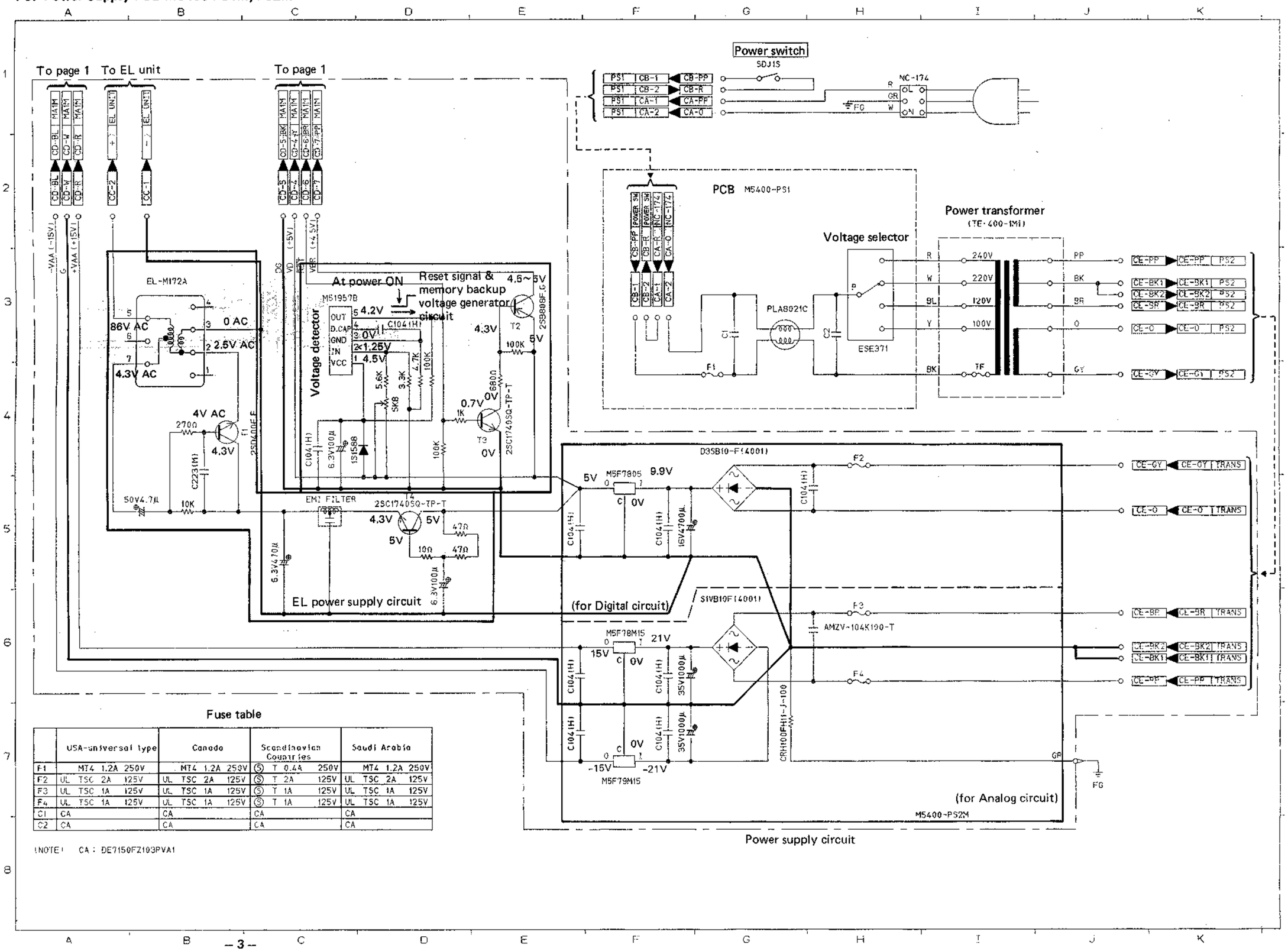
1-3. Power Supply PCB M5400-PS1M, PS2M

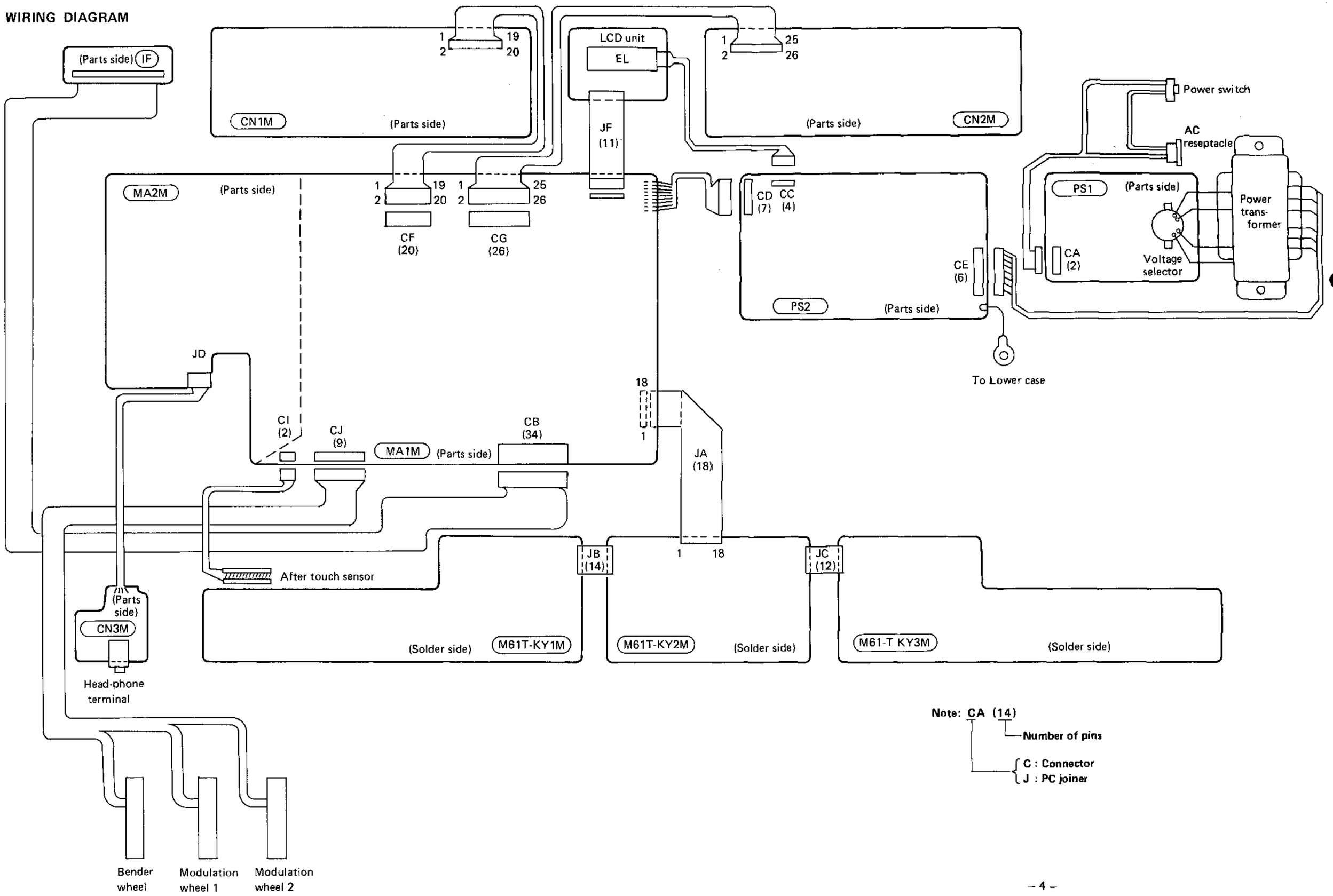


Fuse table

	USA-universal type	Canada	Scandinavian Countries	Saudi Arabia
F1	MT4 1.2A 250V	MT4 1.2A 250V	Ⓢ T 0.4A 250V	MT4 1.2A 250V
F2	UL TSC 2A 125V	UL TSC 2A 125V	Ⓢ T 2A 125V	UL TSC 2A 125V
F3	UL TSC 1A 125V	UL TSC 1A 125V	Ⓢ T 1A 125V	UL TSC 1A 125V
F4	UL TSC 1A 125V	UL TSC 1A 125V	Ⓢ T 1A 125V	UL TSC 1A 125V
C1	CA	CA	CA	CA
C2	CA	CA	CA	CA

(NOTE) CA : DE7150FZ103PVA1

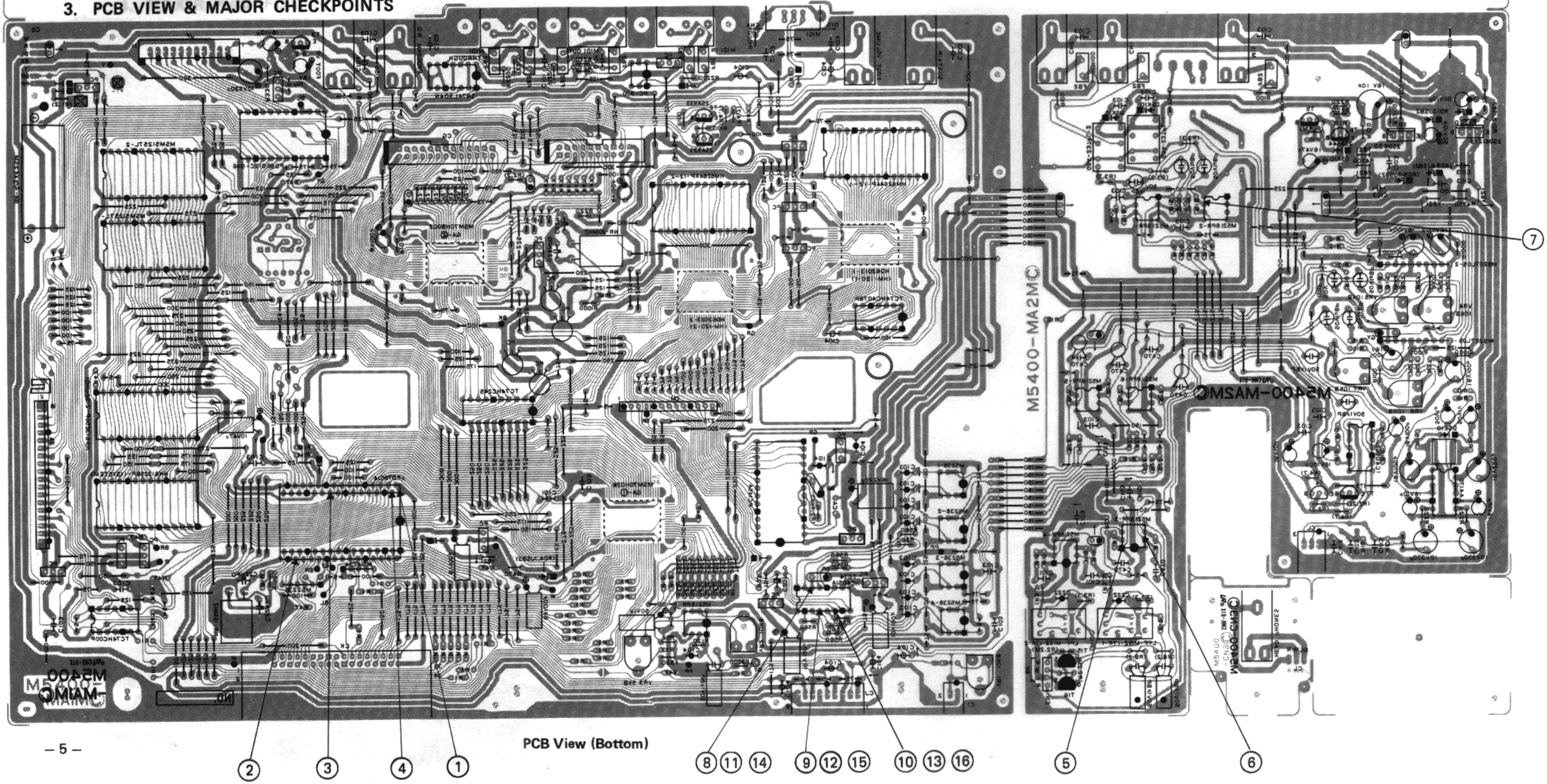
2. WIRING DIAGRAM



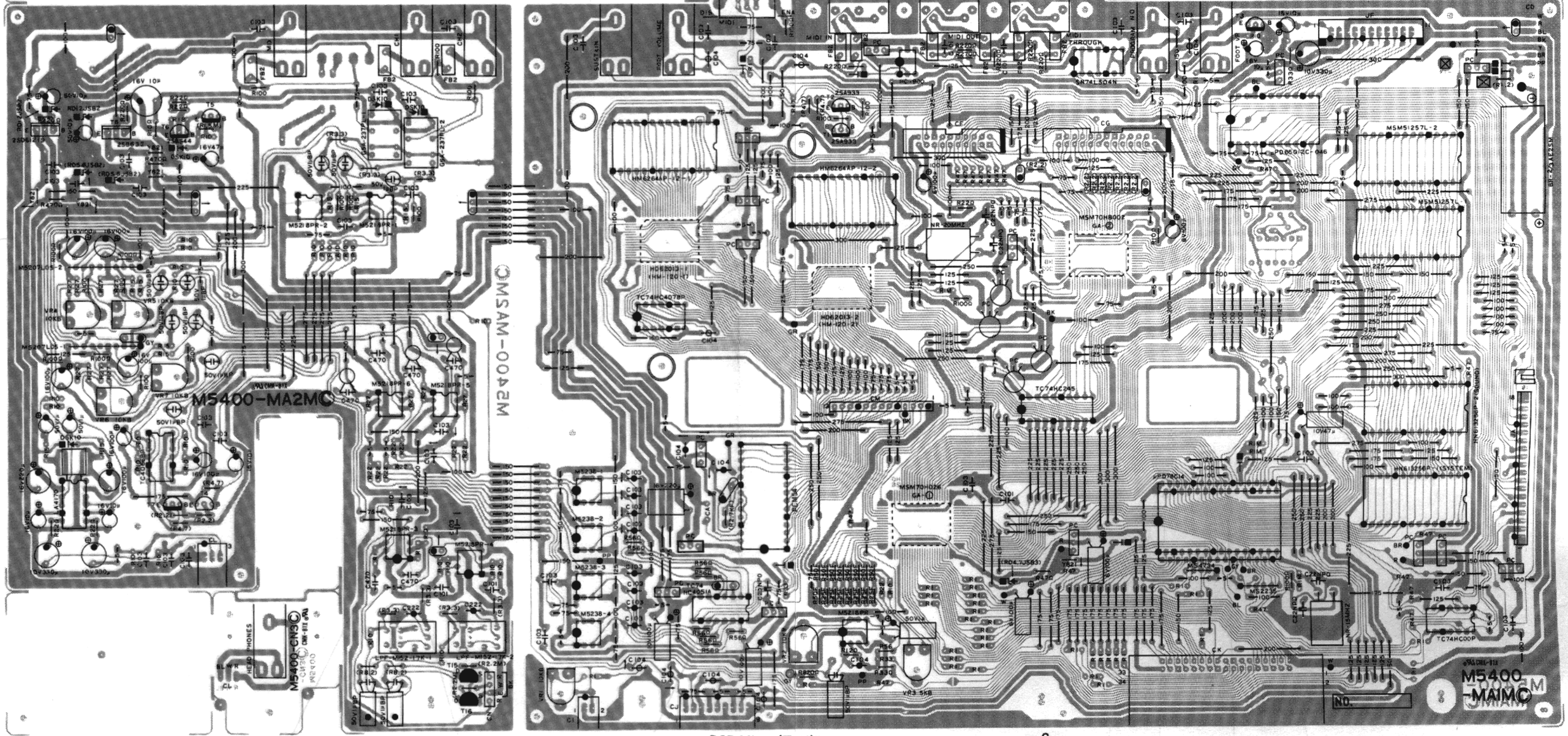
Note: CA (14)

- (14) — Number of pins
- CA — C : Connector, J : PC joiner

3. PCB VIEW & MAJOR CHECKPOINTS



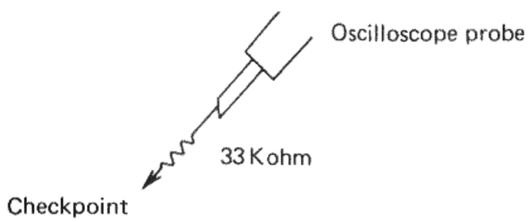
PCB View (Bottom)

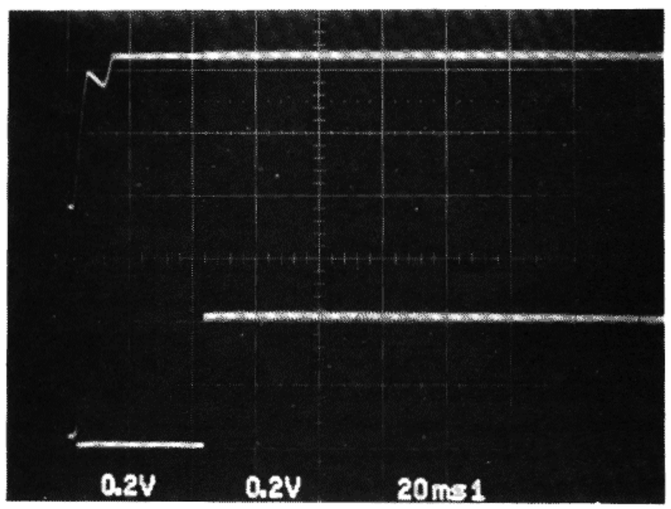


PCB View (Top)

4. MAJOR WAVEFORMS

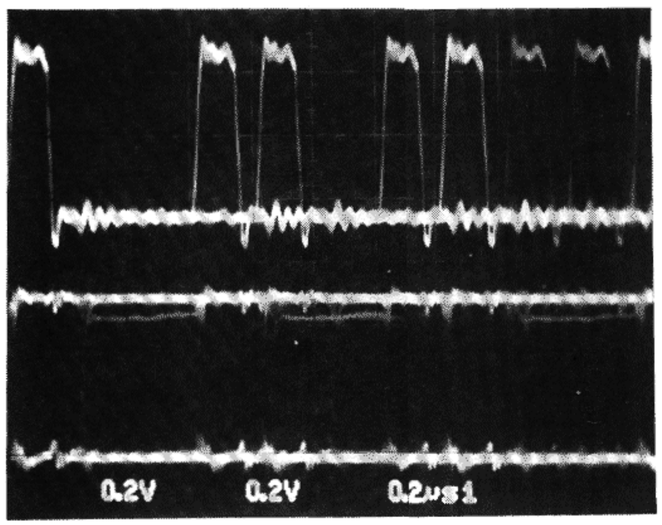
Notes: Probe reduction; 10:1
The analog waveforms were observed via 33Kohm resistor.





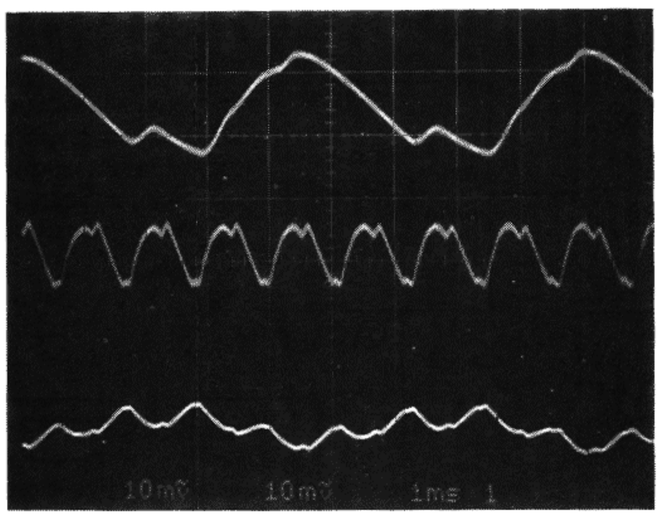
① Voltage VD
μPD78C14G pin 64

② Reset signal
μPD78C14G pin 28



③ ALE signal
μPD78C14G pin 46

④ Data signal
μPD78C14G pin 62

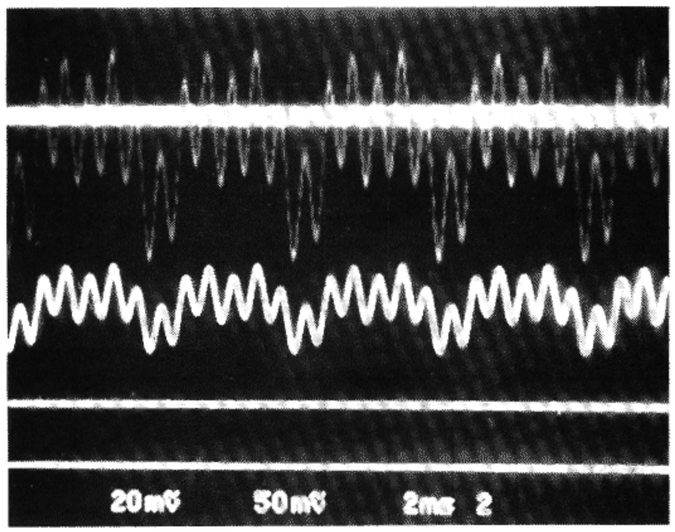


⑤ Line-out 2 signal
M5218PR-3 pin 1

⑥ Line-out 1 signal
M5218PR-3 pin 7

⑦ Mix-out signal
M5218PR-2 pin 7

Tone: B-8 Horn/Strings
Key: A2/A4

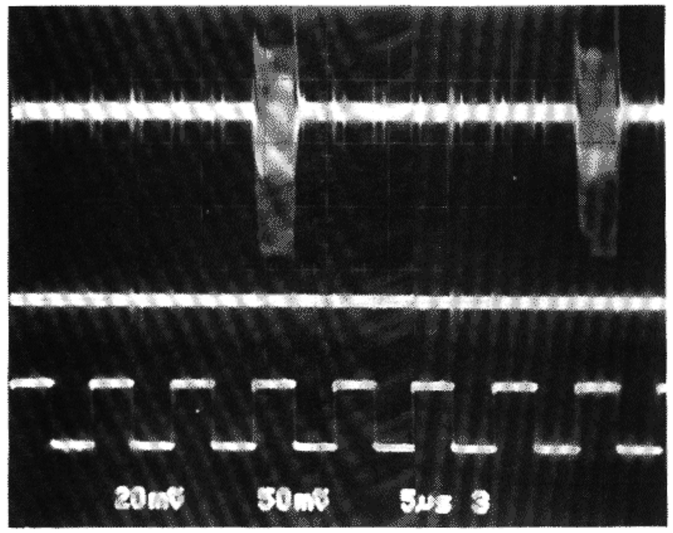


⑧ DAC output
PCM54 pin 19

⑨ Multiplexer output
TC74HC4051AP pin 13

⑩ Multiplexer control
TC74HC4051AP pin 11

Tone: C-8 Pipe Synth.
Key: A3

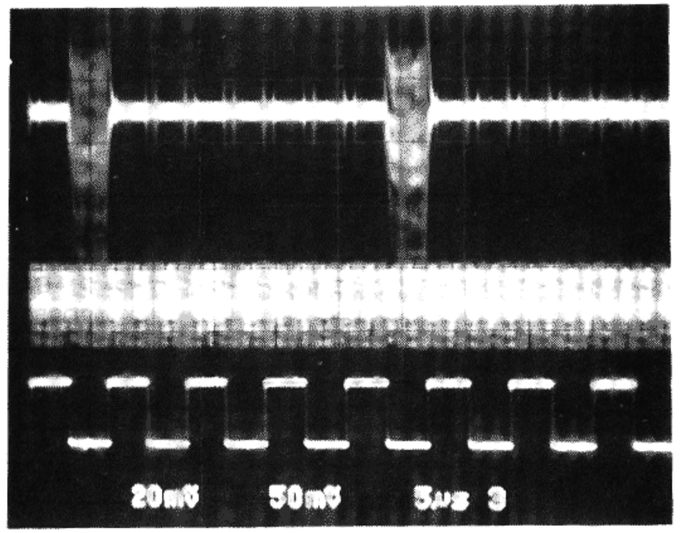


⑪ DAC output
PCM54 pin 19

⑫ Multiplexer output
TC74HC4051AP pin 13

⑬ Multiplexer control
TC74HC4051AP pin 11

Tone: C-8 Pipe Synth.
Key: A3
At channel 5 selected



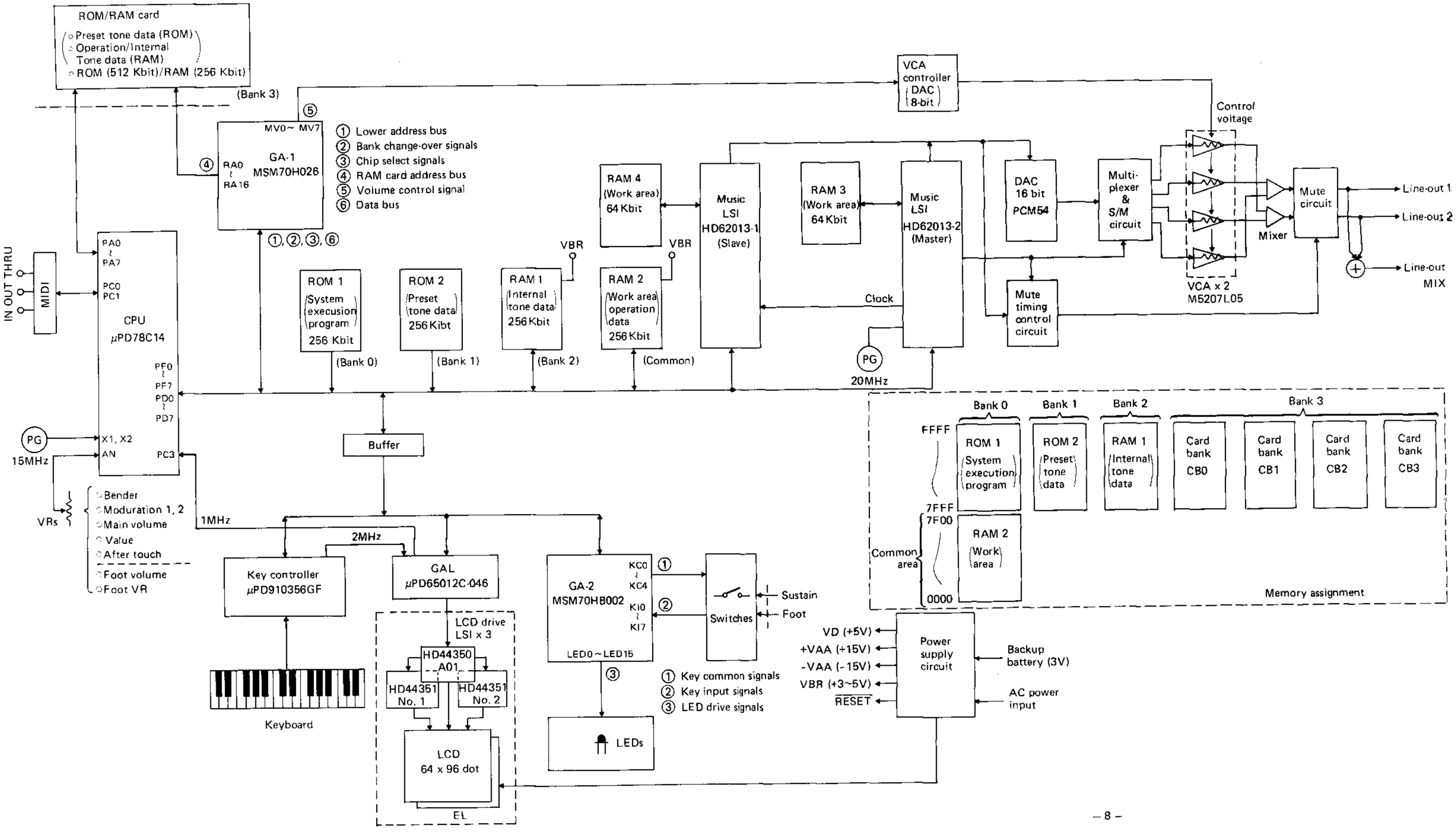
⑭ DAC output
PCM54 pin 19

⑮ Multiplexer output
TC74HC4051AP pin 13

⑯ Multiplexer control
TC74HC4051AP pin 11

Tone: C-8 Pipe Synth.
Key: A3
At channel 0 selected

5. BLOCK DIAGRAM



6. MAJOR LSI PIN FUNCTIONS

6-1. CPU (μPD78C14)

- ○ Contains 16Kbyte ROM and eight built-in ADCs (Analog to Digital Converters).
- ○ Controls all peripheral devices.
- ○ Inputs/Outputs RAM/ROM data directly.

Pin No.	Terminal	Signal	In/Out	Function
1 ~ 8	PA0 ~ PA7	C0 ~ C7	Out	Data (I/O1 ~ I/O8) for RAM/ROM card
9	PB0	CD	In	RAM/ROM card detection signal. CPU discriminates that a RAM/ROM card is inserted when it receives Low level from this terminal.
10	PB1	RA19	Out	Chip select signal for RAM/ROM card. When Low, RAM/ROM card can be designated.
11	PB2	$\overline{WE}$	Out	Write enable signal for RAM card. When Low, data can be written in RAM card.
12	PB3	$\overline{OE}$	Out	Output enable signal for RAM/ROM card. When Low, data can be output from RAM/ROM card.
13	PB4	$\overline{CE}$	Out	Chip enable signal for RAM/ROM card. When High, data can be transferred between RAM/ROM card and CPU.
14	PB5	MR	Out	Output enable signal for internal latch of LSI GA2. When Low, LSI GA2 is able to provide key common and LED drive signals.
15	PB6	MM0	Out	Mute signal. This terminal becomes High when the main VR is set in the minimum position.
16	PB7	MM1	Out	Split/Mix change-over signal. Mix .... High Split ... Low
17	PC0	TXD	Out	MIDI (Musical Instrument Digital Interface) data output.
18	PC1	RXD	In	MIDI data input.
19	PC2			No function
20	PC3	1MHz	Out	Clock signal for MIDI
21	PC4		In	Fixed Ground (0V)
22	PC5		In	Fixed High (+5V)
23	PC6	RES	Out	Reset signal output for key touch LSI (μPD910356GF)
24	PC7	$\overline{RDY}$	In	Ready signal from GAL input. CPU detects ready status of LSI GAL.
25~27				No function
28	$\overline{RESET}$	$\overline{RST}$	In	When the power switch is turned on, the terminal receives Low level signal for approximately 100mS during which CPU internal circuits are reset.

Pin No.	Terminal	Signal	In/Out	Function
29				No function
30, 31	X2, X1		Out/In	15MHz clock signal output/input
32	VSS			Ground (0V) source
33	AVSS			Ground (0V) source for built-in ADCs (Analog to Digital Converters)
34~41	AN0 ~ AN7		In	Inputs from control pots. Voltage level from each pot is converted into digital data in a built-in ADC. AN0 ..... Pitch bender AN1 ..... Moduration wheel 1 AN2 ..... Moduration wheel 2 AN3 ..... Main volume control AN4 ..... Value AN5 ..... After touch sensor AN6 ..... Foot VR (Output volume) AN7 ..... Foot VR (Sound effect)
42	VAREF	VDA		Reference voltage (+5V) for built-in ADCs.
43	AVCC	VD		+5V source for built-in ADCs.
44	$\overline{RD}$	$\overline{RD}$	Out	Read signal output.
45	$\overline{WR}$	$\overline{WR}$	Out	Write signal output. Low when CPU writes data into peripheral devices.
46	ALE	ALE	Out	Address latch enable signal output. At the rising edge of this signal, data bus (D0 ~ D7) become lower address signals (A0 ~ A7).
47~54	PF0 ~ PF7	A8 ~ A15	Out	Upper address bus for peripheral devices.
55~62	PD0 ~ PD7	D0 ~ D7	In/Out	Data bus for peripheral devices.
63, 64	VDD, VCC			+5V source.

6-2. GA1 (MSM70H026)

- ○ Generates the RAM/ROM card address and the lower address for the peripheral devices.
- ○ Controls the RAMs/ROMs banks change-over, chip selection for the peripheral devices and the output volume.

Pin No.	Terminal Name	In/Out	Function
1	VDD		+5V source
2			No connection
3	VSS		Ground (0V) source
4 ~ 20	RA0 ~ RA16	Out	Address signal for RAM/ROM card RAM card RA15, 16 : no function ROM card RA16 : no function
21	VSS		Ground (0V) source
22			No connection
23	VDD		+5V source
24~31	MV7 ~ MV0	Out	VCA (Voltage Controlled Amplifier) control signals
32			No connection
33~39	$\overline{CS0}$ ~ $\overline{CS6}$	Out	Chip select signal for peripheral devices $\overline{CS0}$ . . . . . Key controller (μPD910356GF) chip selection $\overline{CS1}$ . . . . . GA-2 (MSM70HB002) chip selection $\overline{CS3}$ . . . . . GAL (μPD65012C-046) chip selection $\overline{CS4}$ . . . . . Music LSI (Master) HD62013-2 chip selection $\overline{CS5}$ . . . . . Music LSI (Slave) HD62013-1 chip selection
40	$\overline{RD2}$	Out	Read signal output for the work RAM
41			No connection
42	VDD		+5V source
43			No connection
44	VSS		Ground (0V) source
45	$\overline{WT2}$	Out	Write signal output for the work RAM
46	G	Out	Enable signal for bi-directional gate. Low active.
47~61	A0 ~ A14	In	Address signals (A0 ~ A14) input
62	VSS		Ground (0V) source
63			No connection
64	VDD		+5V source
65	A15	In	Address signal (A15) input
66~69	$\overline{A15}$, B0 ~ B2	Out	Chip select signals for memory devices B0 . . . . . ROM1 (System program) chip selection B1 . . . . . ROM2 (Preset tone data) chip selection B2 . . . . . RAM1 (Operation/Internal tone data) chip selection $\overline{A15}$ . . . . RAM2 (Work area) chip selection
70	$\overline{RD}$	In	Read signal input. The LSI outputs data to CPU when this terminal is Low.
71	$\overline{WR}$	In	Write signal input. This LSI inputs data from CPU when the terminal is Low.
72	ALE	In	Address latch enable signal input for internal address latch.
73~80	D0 ~ D7	In/Out	Data bus between CPU

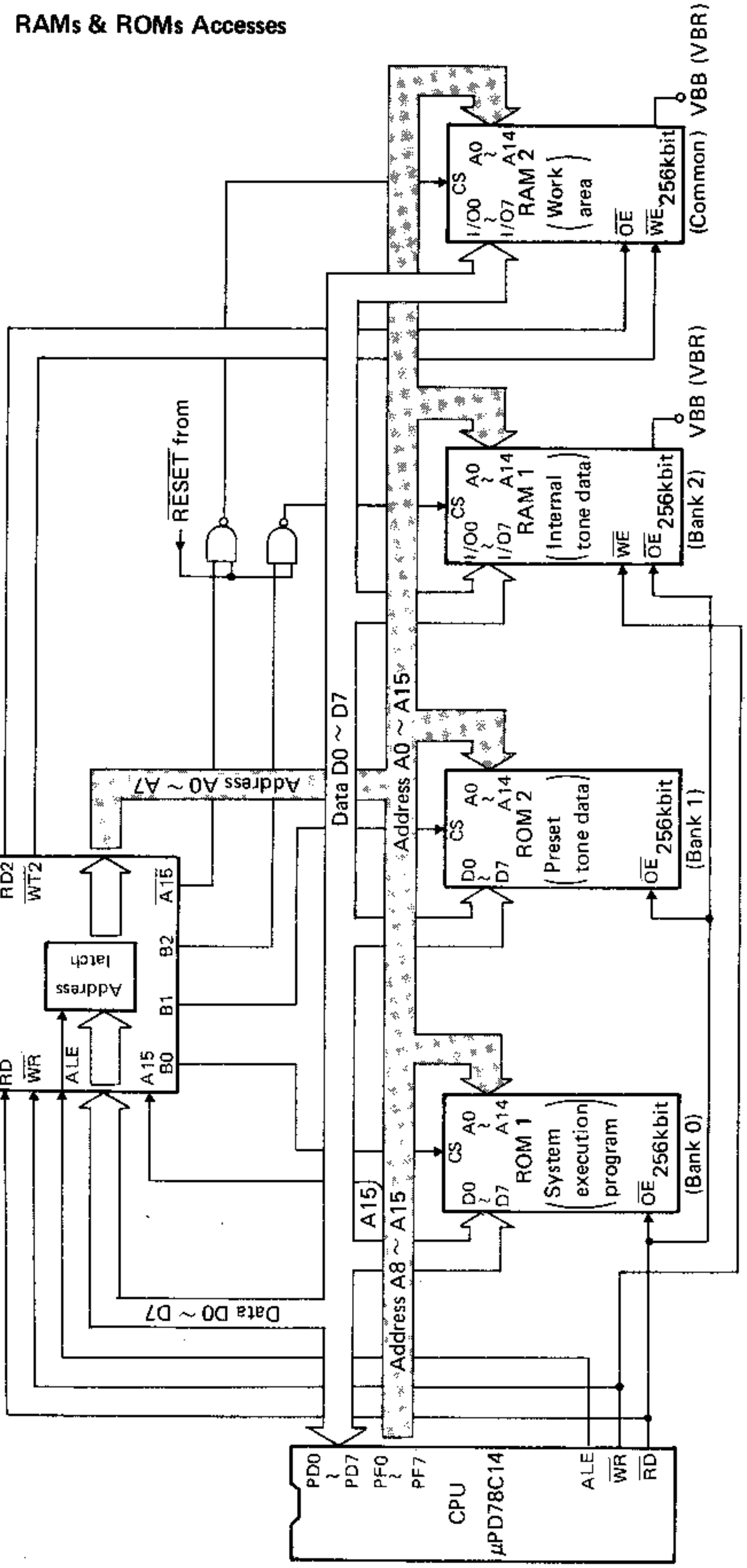
6-3. GA2 (MSM70HB002)

○ Scans the switches and drives the LEDs.

Pin No.	Terminal Name	In/Out	Function
1	BA0	In	Address signal (A0) input
2	GIN		Ground (0V) source
3	VDD		+5V source
4	GOUT	Out	Ground (0V) source
5, 6	LED1, LED2	Out	LEDs drive signals output
7 ~ 9	BD7 ~ BD5	In/Out	Data bus (D5 ~ D7) between CPU
10	VDD		+5V source
11	GOUT	Out	Ground (0V) source
12 ~ 16	BD4 ~ BD0	In/Out	Data bus (D0 ~ D4) between CPU
17 ~ 19			No connection
20	GOUT	Out	Ground (0V) source
21	VDD		+5V source
22	GIN		Ground (0V) source
23	$\overline{CS1}$	In	Chip select signal input. The LSI becomes functional when the terminal receives Low level signal.
24	MR	In	Output enable signal for internal latch. GA2 outputs key common and LED drive signals when the terminal is Low.
25 ~ 31			No connection
32	VDD		+5V source
33	GOUT		Ground (0V) source
34 ~ 37			No connection
38 ~ 42	LED11 ~ LED15	Out	LEDs drive signals output
43	GIN		Ground (0V) source
44	VDD		+5V source
45	GOUT	Out	Ground (0V) source
46 ~ 50	KC0 ~ KC4	Out	Key common signals (KC0 ~ KC4) output
51	VDD		+5V source
52	GOUT	Out	Ground (0V) source
53 ~ 60	KI0 ~ KI7	In	Key input signals (KI0 ~ KI7).
61	GOUT	Out	Ground (0V) source
62	VDD		+5V source
63	GIN		Ground (0V) source
64 ~ 68	LED10 ~ LED6	Out	LEDs drive signals output
69	VDD		+5V source
70	GOUT	Out	Ground (0V) source
71			No connection
72 ~ 75	LED5 ~ LED2	Out	LEDs drive signals output
76, 77			No connection
78	$\overline{BRD}$	In	Read signal for internal buffer. The LSI reads key input signals when this terminal is Low.
79	$\overline{BWR}$	In	Write signal for internal latches. The LSI takes data for LED driving and key common signals.
80	BA1	In	Address signal (A1) input.

7. MEMORY DEVICES ACCESSES

7-1. RAMs & ROMs Accesses



Lower address bus (A0 ~ A7) is provided from LSI GA-1. When signal ALE from CPU rises to High, data bus (D0 ~ D7) becomes address bus (A0 ~ A7) in LSI GA-1.

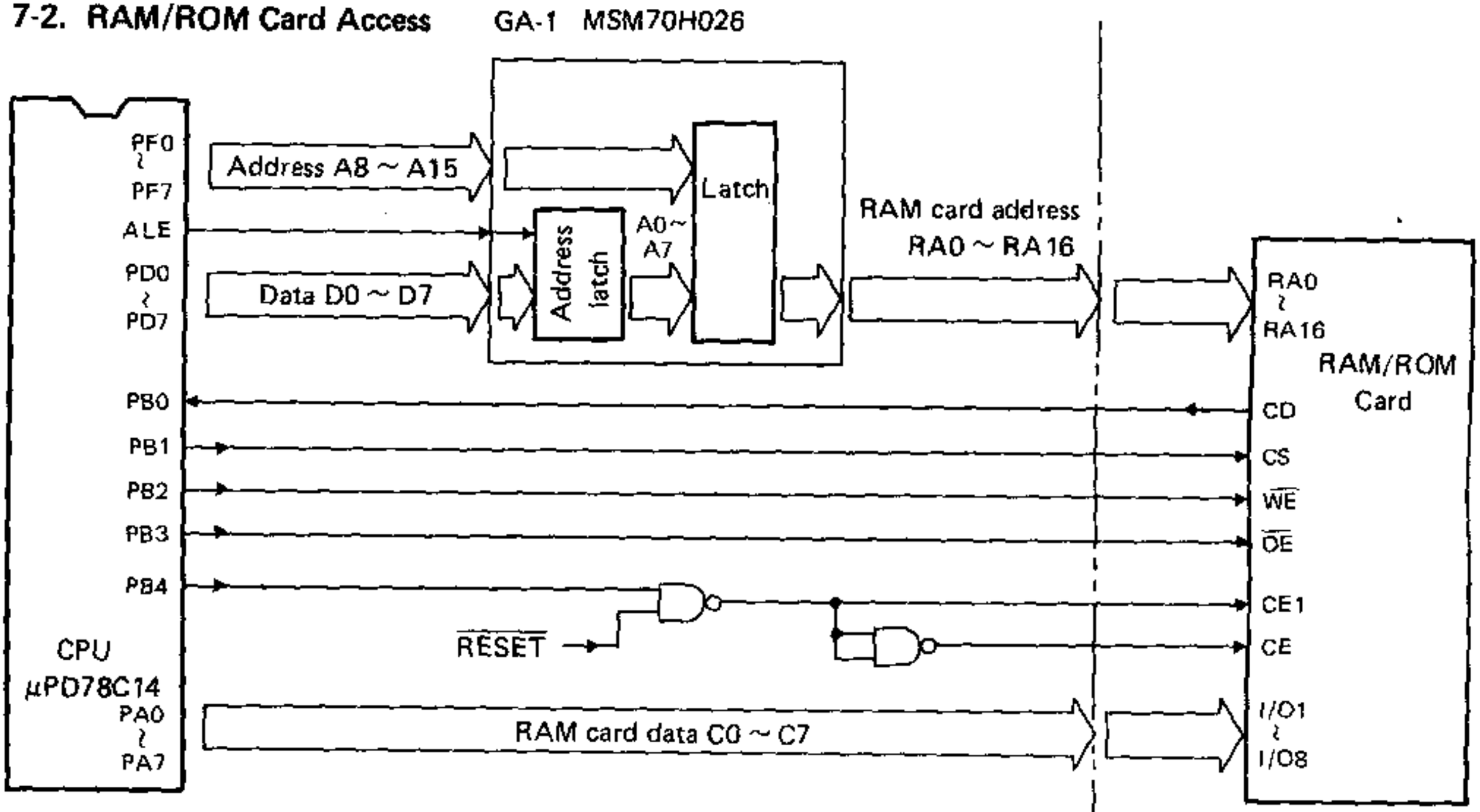
Upper address bus (A8 ~ A15) is directly supplied from CPU.

Chip select signals are provided from the LSI GA-1.

The RAMs are backed-up by the voltage VBB (VBR) of the lithium battery when power switch is off.

Data are not written in RAMs when power switch is turned on to prevent mis-entry of data.

7-2. RAM/ROM Card Access GA-1 MSM70H026



Note: The following signals are not used:

RAM card . . . RA15, 16
ROM card . . . RA16

The RAM card has 32 Kbyte capacity and records Operation/Internal tone data.
Whereas the ROM card's capacity is 64 Kbyte and contains preset tone data.
CPU controls RAM/ROM card and output data directly to RAM card.
The GA-1 outputs address signals for RAM/ROM card.

8. KEYBOARD CONTROL

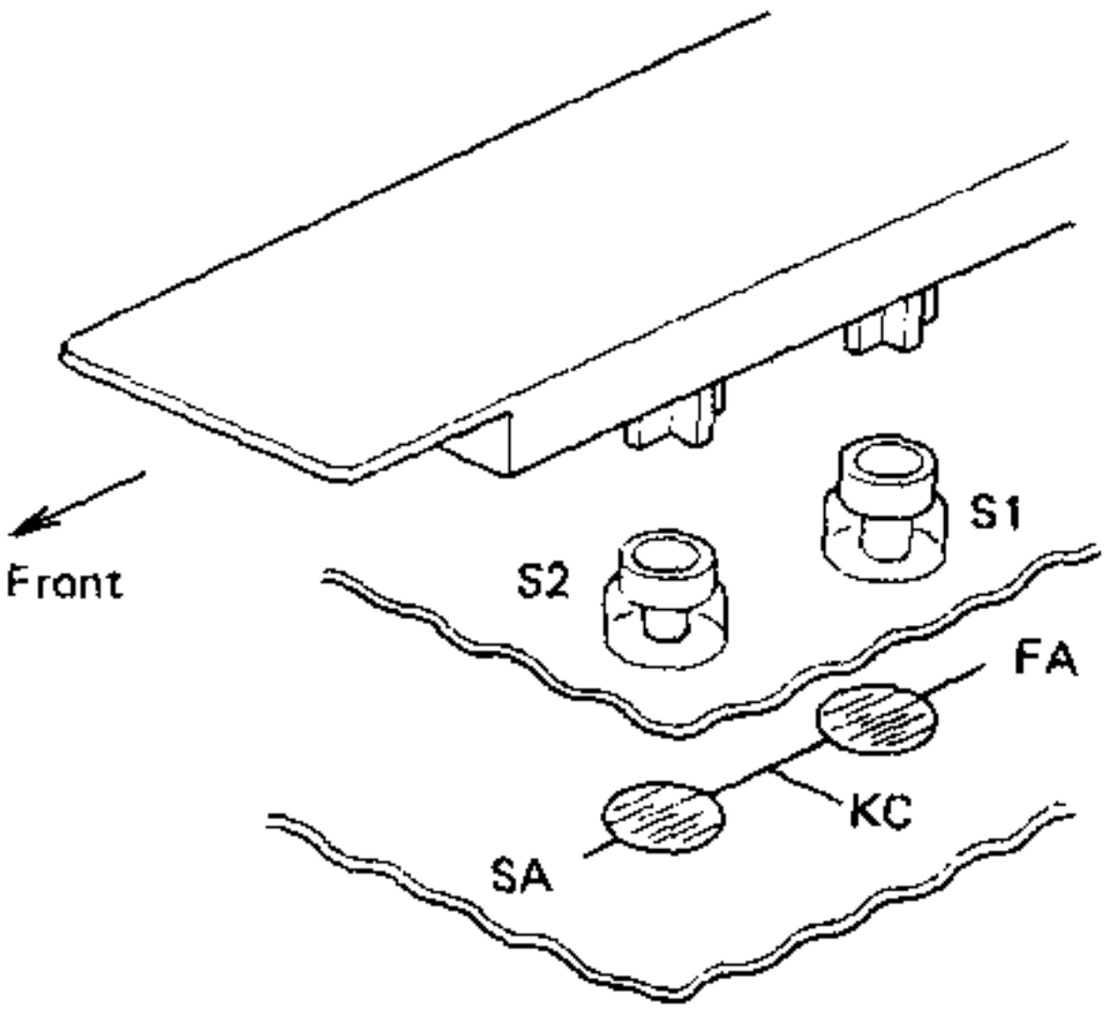
8-1. Key Controller (μPD910356GF)

○ The LSI sends velocity and note number of hit key.

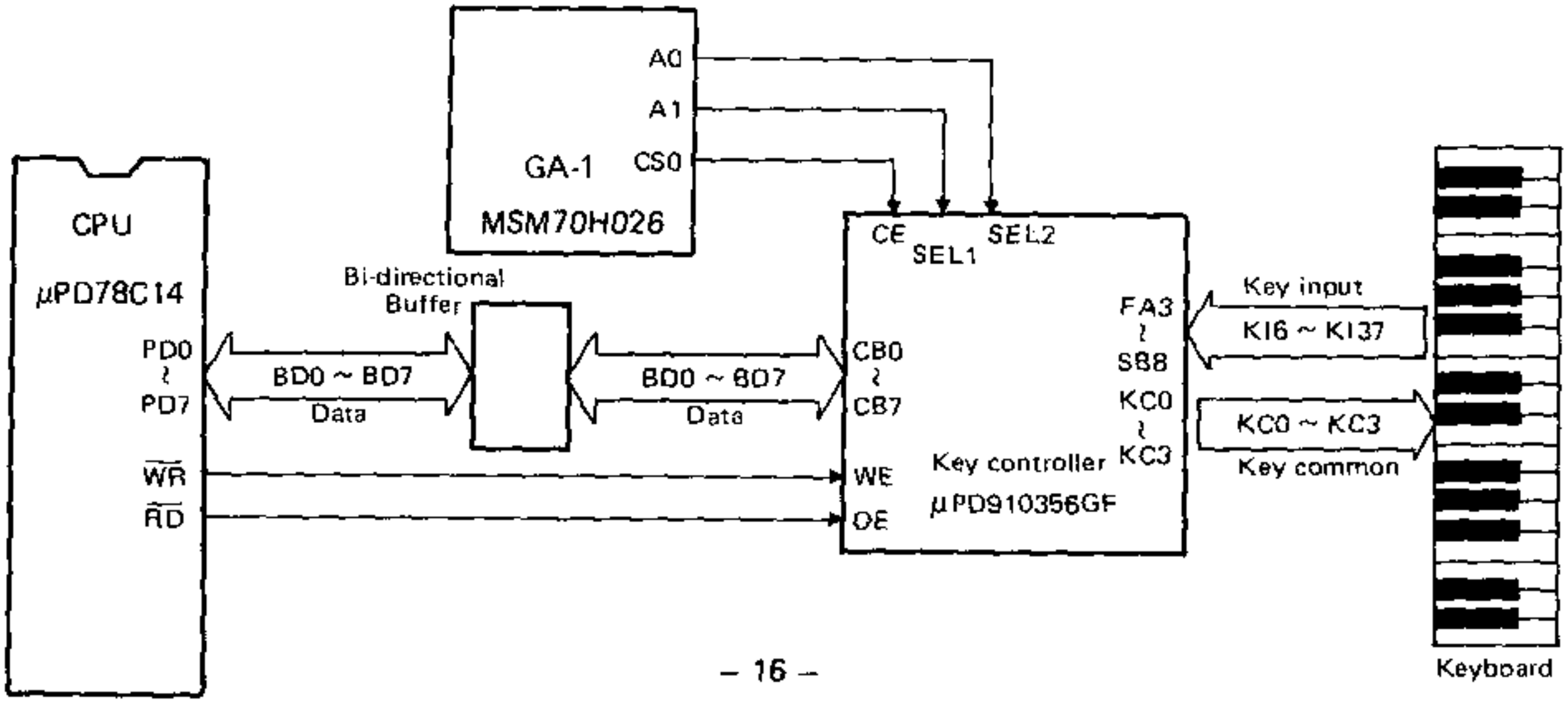
Pin No.	Terminal	Signal	In/Out	Function
1, 2	GND			Ground (0V) source
3 ~ 14	FB3 ~ FB8 SB3 ~ SB8	KI26~KI37	In	Key input terminals
15 ~ 21				No function
22	GND			Ground (0V) source
23	VDD			+5V source
24	GND			Ground (0V) source
25 ~ 32	CB0 ~ CB7	BD0 ~ BD7	In/Out	Data bus (D0 ~ D7) between CPU
33	GND			Ground (0V) source
34				No function
35	CE	$\overline{CS0}$	In	Chip enable signal input. When Low, the LSI is able to communicate with CPU.
36	OE	$\overline{BRD}$	In	Read signal input. The LSI outputs data to CPU when this terminal is Low.
37	WE	$\overline{BWR}$	In	Write signal input. The LSI inputs data from CPU when this terminal is Low.
38, 39	SEL0, SEL1	BA0, BA1	In	Address signals input for internal accumulator.
40	RST	RES	In	Reset signal input. When the power switch is turned ON, the terminal receives Low level signal which LSI internal circuits are reset.
41	DCO	2MHz	Out	Clock pulse signal (2MHz) for LSI GAL output.
42, 43	GND			Ground (0V) source.
44				No function
45, 46	XIN, XOUT		In/Out	Clock pulse signal (8MHz) input/output.
47, 48	VDD			+5V source
49 ~ 52	KC0 ~ KC3	KC0 ~ KC3	Out	Key common signals output
53 ~ 58				No function
59 ~ 62	FA3, FA4 SA3, SA4	KI6 ~ KI9	In	Key input signals terminals
63	VDD			+5V source
64	GND			Ground (0V) source
65 ~ 80	FA5 ~ FA9 SA5 ~ SA9 FB0 ~ FB2 SB0 ~ SB2	KI10~KI25	In	Key input signals terminals

8-2. Key Touch Detection Circuit

Each key has two key contact switches S1 and S2.



At first, the key controller detects the note number by the key matrix shown next page. When a key is hit, S1 turns on first, then S2. The interval time between turning on of S1 and S2 varies according to the touch velocity of the key.
The key controller detects the time interval and determines the key velocity.
Then key controller transfers these data to the CPU.

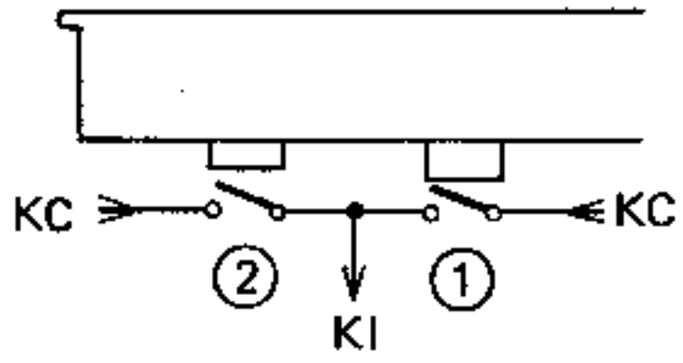


8-3. Key Matrix

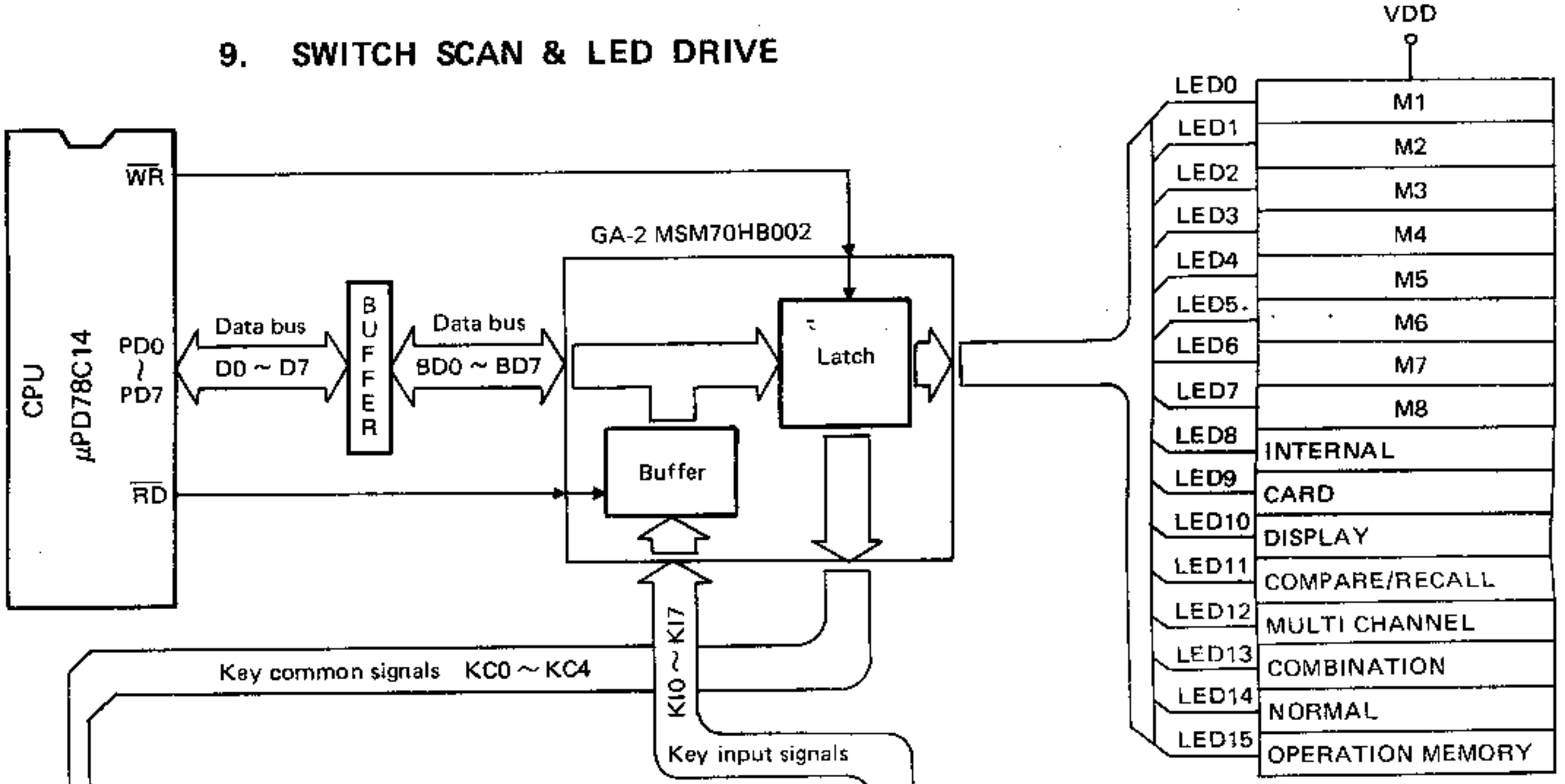
KI/KC	KC0	KC1	KC2	KC3
KI6				C2 ①
KI7				C2 ②
KI8	C#2 ①	D2 ①	D#2 ①	E2 ①
KI9	C#2 ②	D2 ②	D#2 ②	E2 ②
KI10	F2 ①	F#2 ①	G2 ①	G#2 ①
KI11	F2 ②	F#2 ②	G2 ②	G#2 ②
KI12	A2 ①	A#2 ①	B2 ①	C3 ①
KI13	A2 ②	A#2 ②	B2 ②	C3 ②
KI14	C#3 ①	D3 ①	D#3 ①	E3 ①
KI15	C#3 ②	D3 ②	D#3 ②	E3 ②
KI16	F3 ①	F#3 ①	G3 ①	G#3 ①
KI17	F3 ②	F#3 ②	G3 ②	G#3 ②
KI18	A3 ①	A#3 ①	B3 ①	C4 ①
KI19	A3 ②	A#3 ②	B3 ②	C4 ②
KI20	C#4 ①	D4 ①	D#4 ①	E4 ①
KI21	C#4 ②	D4 ②	D#4 ②	E4 ②

KI/KC	KC0	KC1	KC2	KC3
KI22	F4 ①	F#4 ①	G4 ①	G#4 ①
KI23	F4 ②	F#4 ②	G4 ②	G#4 ②
KI24	A4 ①	A#4 ①	B4 ①	C5 ①
KI25	A4 ②	A#4 ②	B4 ②	C5 ②
KI26	C#5 ①	D5 ①	D#5 ①	E5 ①
KI27	C#5 ②	D5 ②	D#5 ②	E5 ②
KI28	F5 ①	F#5 ①	G5 ①	G#5 ①
KI29	F5 ②	F#5 ②	G5 ②	G#5 ②
KI30	A5 ①	A#5 ①	B5 ①	C6 ①
KI31	A5 ②	A#5 ②	B5 ②	C6 ②
KI32	C#6 ①	D6 ①	D#6 ①	E6 ①
KI33	C#6 ②	D6 ②	D#6 ②	E6 ②
KI34	F6 ①	F#6 ①	G6 ①	G#6 ①
KI35	F6 ②	F#6 ②	G6 ②	G#6 ②
KI36	A6 ①	A#6 ①	B6 ①	C7 ①
KI37	A6 ②	A#6 ②	B6 ②	C7 ②

Each key has two contacts ① and ②. When a key is hit, key controller receives key input signals from contact ① first then from ②.
Descriminating the period between the inputs from contacts ① and ②, key controller sends velocity data to the CPU with the note number data.



9. SWITCH SCAN & LED DRIVE

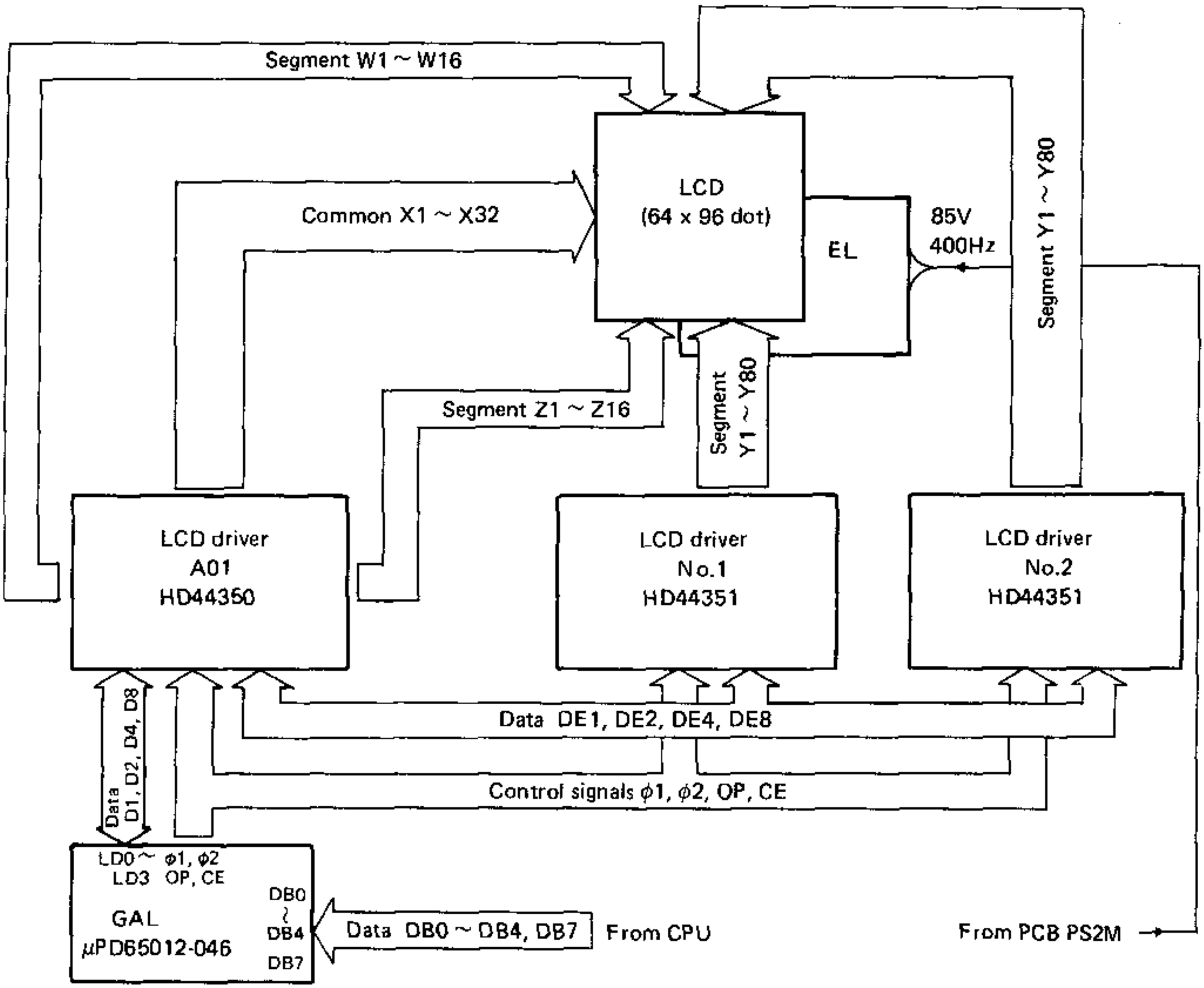


	KI0	KI1	KI2	KI3	KI4	KI5	KI6	KI7
KC0	A	B	C	D	E	F	G	H
KC1	1	2	3	4	5	6	7	8
KC2	DISPLAY	LINE	INTERNAL	PAGE DOWN	PAGE UP	CARD	(SUSTAIN)	(PROGRAM NO)
KC3	MIDI ON/OFF	OPERATION MEMORY	NORMAL	COMBI-NATION	MULTI CHANNEL	COMPARE/ RECALL	CURSOL ←	CURSOL →
KC4		MENU 1	MENU 2	MENU 3	PLAY	WRITE	NO −	YES +

The CPU controls the LSI GA-2. By receiving the data from the CPU, the GA-2 outputs corresponding LED drive signals (LED0 ~ LED15) and key common signals KC0 ~ KC4.

10. LCD CONTROL

10-1. LCD Drive Circuit



The LCD is driven by three LSIs.
The LSI HD44350 generates the common signals X1 ~ X32 for upper and lower part of the LCD, lower segment signal Z1 ~ Z16 and upper W1 ~ W16. Also this LSI controls two of HD44351s.
Both HD44351 generate segment signals Y1 ~ Y80 for lower and upper part.
The GAL μPD65012-046 generates data and control signals for three LCD drivers from the CPU data.
An EL of LCD back light is driven by about 85V 400 Hz voltage. The voltage is supplied from power supply circuit.

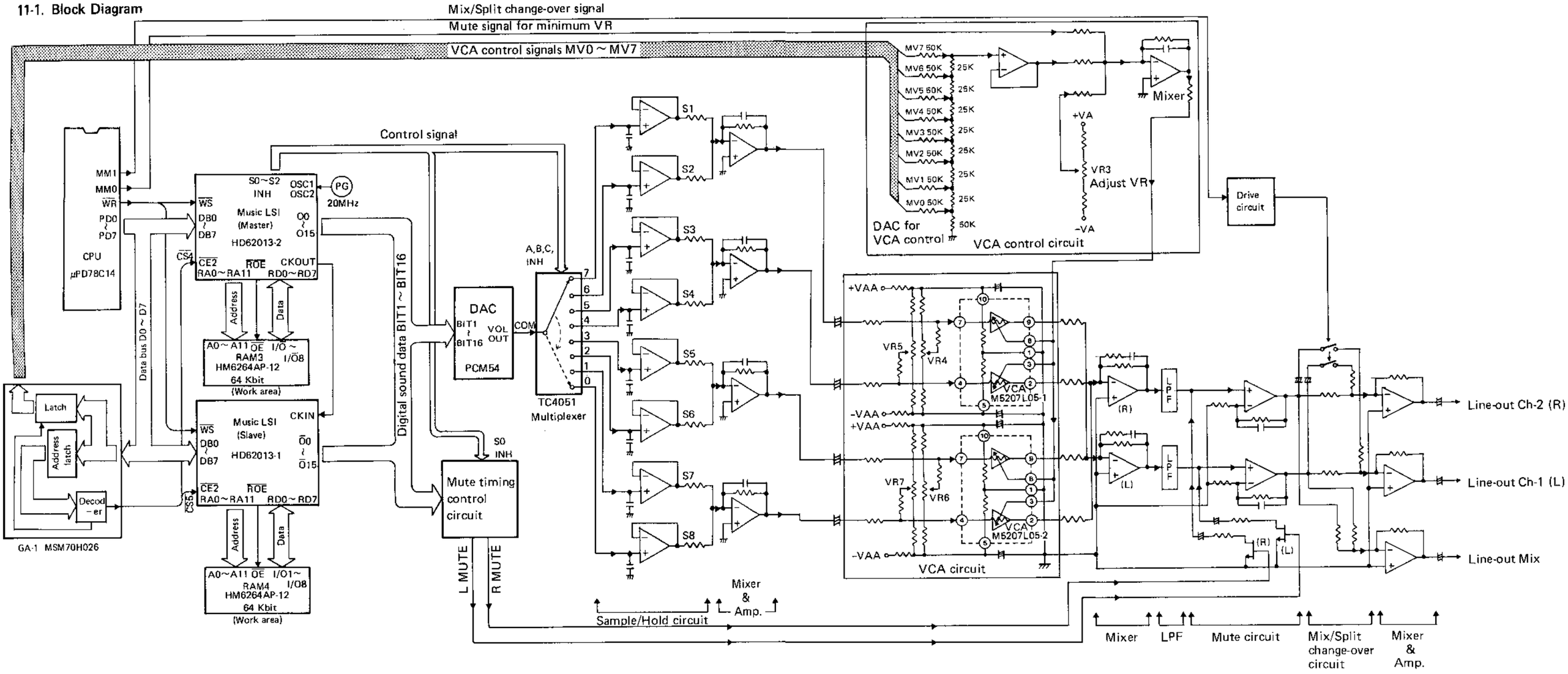
10-2. GAL (μPD65012C-046)

○ Converts 6-bit data from the CPU into 4-bit data for the LCD drivers.

Pin No.	Terminal	Signal	In/Out	Function
1	RES	$\overline{RESET}$	In	Reset signal input. When the power switch is turned ON, the terminal receives Low level signal for a while in which LSI internal circuits are reset.
2				No function
3	RDY	$\overline{RDY}$	Out	Ready signal output. The LSI outputs Low level signal when it is available.
4	CS	$\overline{CS3}$	In	Chip select signal input. When Low, the LSI is able to communicate with CPU.
5	WE	$\overline{BWR}$	In	Write enable signal input. The LSI inputs data from CPU when this terminal is Low.
6~11	DB7, DB4~DB0	DB7 DB4~DB0	In	Data bus (D0 ~ D4, D7)
12	GND			Ground (0V) source
13~16	LD0~LD3	D1, D2, D3 D4	Out	Data bus for LCD drive LSI
17	LCE	CE	Out	Chip enable signal for LCD drive LSI. When the LSI outputs data, this terminal becomes Low level.
18	LOP	OP	Out	When High, the LIS output data signals from terminals LD0 ~ LD3. When Low, the LSI output address signals from above terminals.
19, 20	PH2, PH1	$\phi1$, $\phi2$	Out	Synchronous signals to LCD drive LSI
21, 22	CK1M, CK0	1MHz	Out	Clock pulse signal (1MHz) output
23	CK1	2MHz	In	Clock pulse signal (2MHz) output
24	VDD			+5V source

11. ANALOG CIRCUIT

11-1. Block Diagram



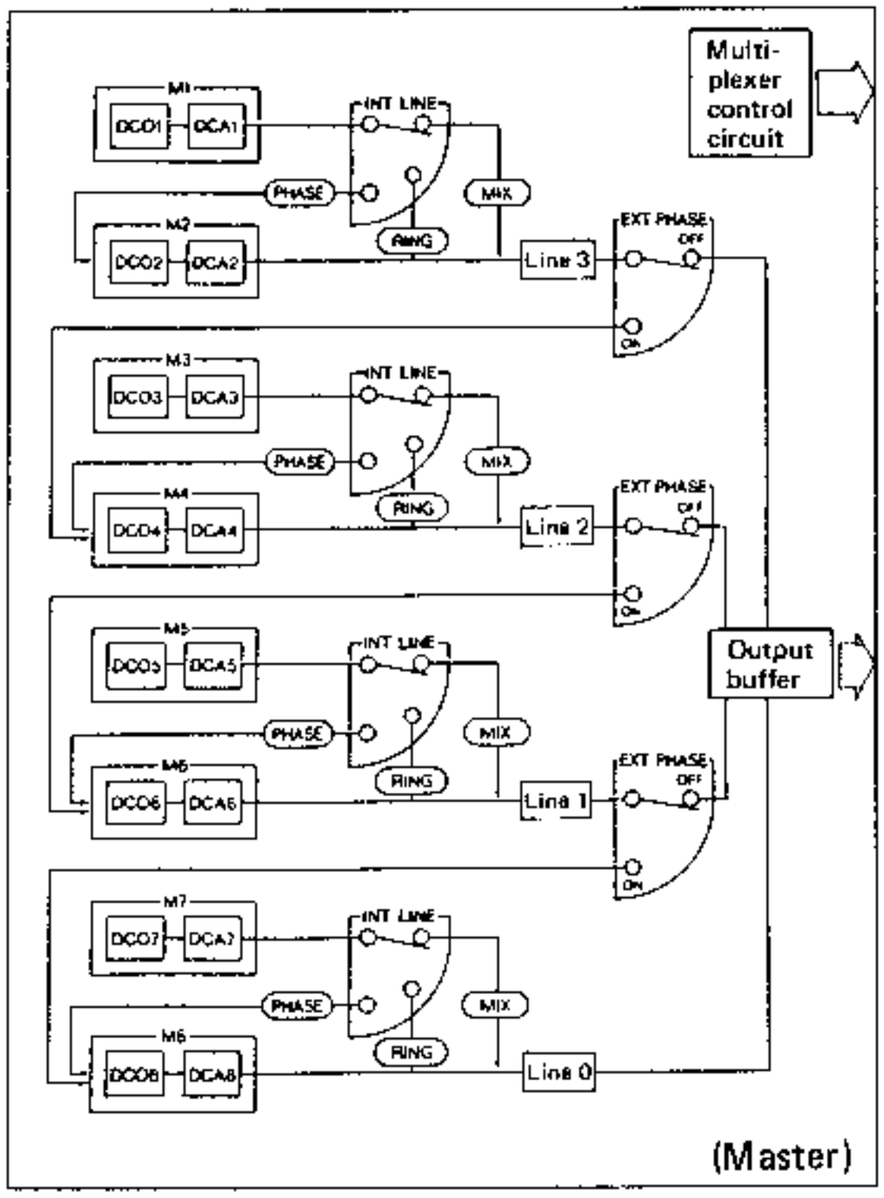
According to hit key, the CPU sends corresponding data to the music LSIs.
The music LSIs generate 16-bit digital sound signals upon receipt of the data.
The DAC (Digital to Analog Converter) converts these signals into a stepped waveform. Since the DAC output signal contains eight different sounds by the time sharing, multiplexer singles out each sound.

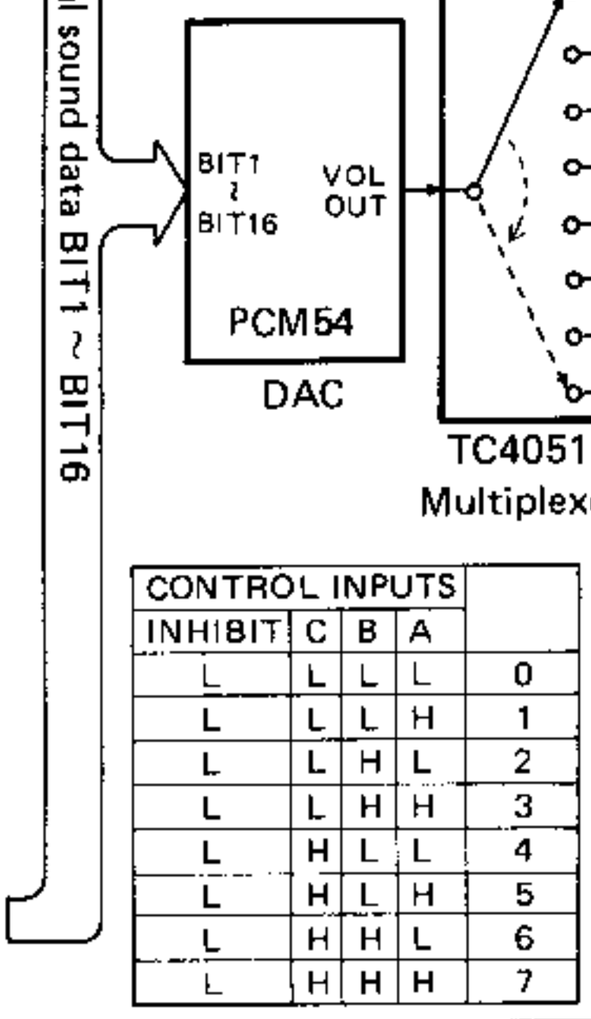
According to the main volume control position, the GA-1 outputs digital signals MV0 ~ MV7 which are converted into a voltage level in VCA control circuit.
The VCAs vary the sound volume in accordance with the control voltage from VCA control circuit.
To shut the volume off completely, the CPU outputs High level signal from the terminal MN0 when the main volume control is at the minimum position.
When no-key is hit, Mute timing control circuit rises signals R MUTE and L MUTE High level to shut the output sound off since Music LSIs may generate noise.

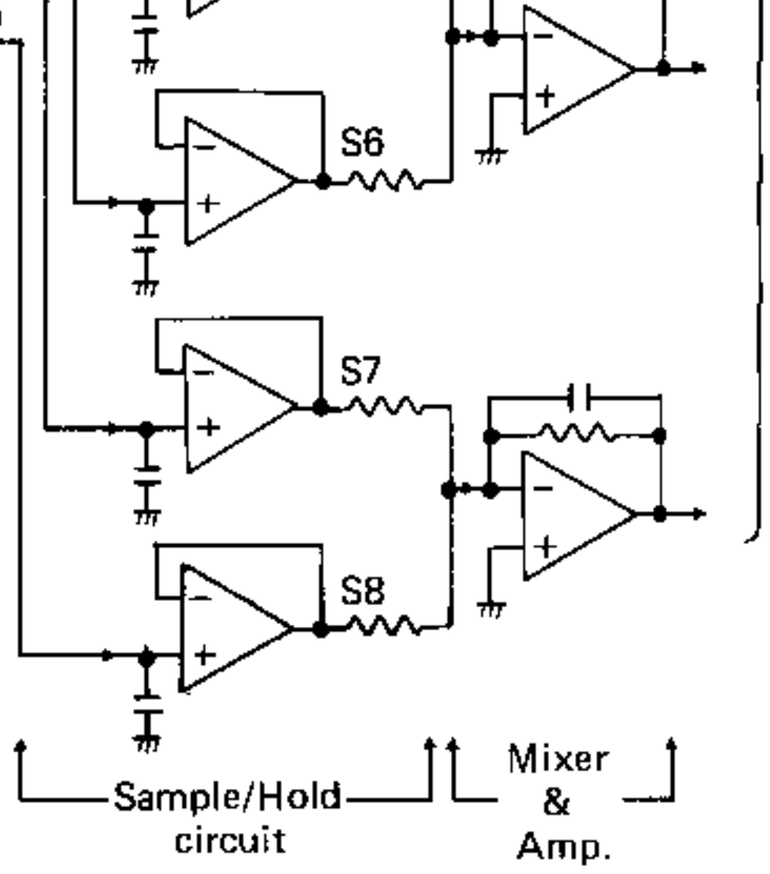
11-2. Principle of the Sound Generation

(1) Block Diagram of Music LSI and peripheral circuits

- ○ Has 8-modules which are constructed by DCO (Digital Controlled Oscillator) and DCA (Digital Controlled Amplifier).
- ○ Generates 16-bit digital sound signals corresponding to hit keys and operation modes.
- ○ Capable to generate maximum 8-notes sound signals (so that VZ-1 can output maximum 16-notes (8-notes x 2 chip = 16 notes) sounds).
- ○ External work area of 64 k-bit capacity is necessary.
- ○ The master music LSI controls the slave music LSI and a multiplexer.

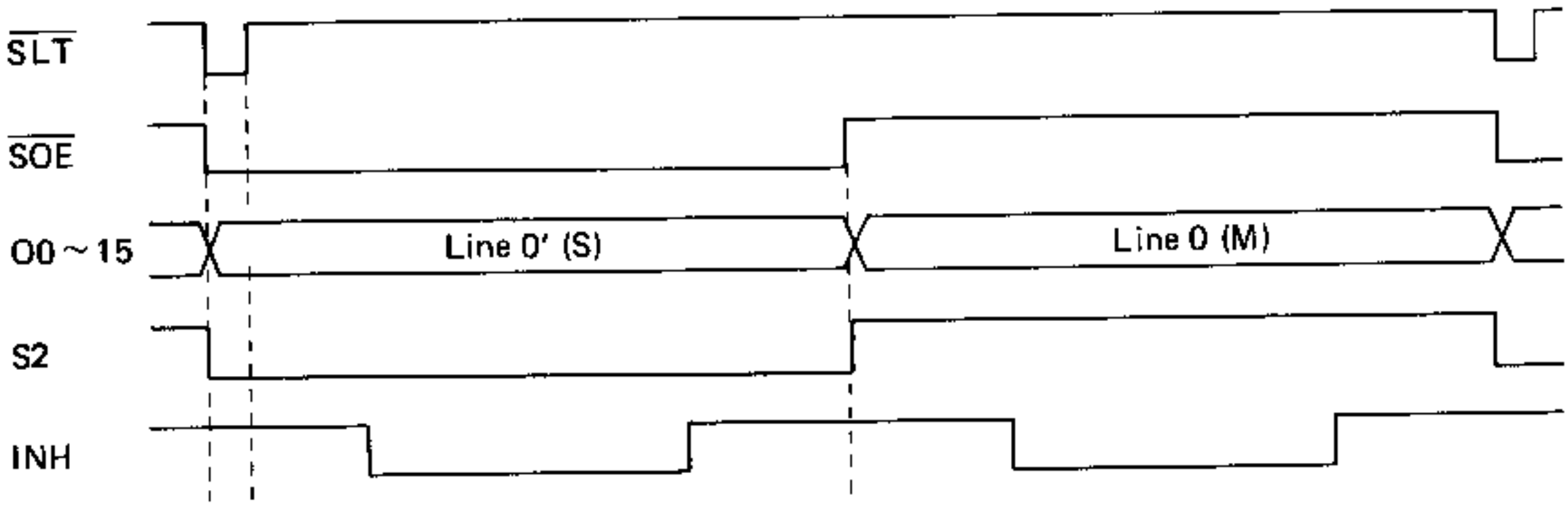




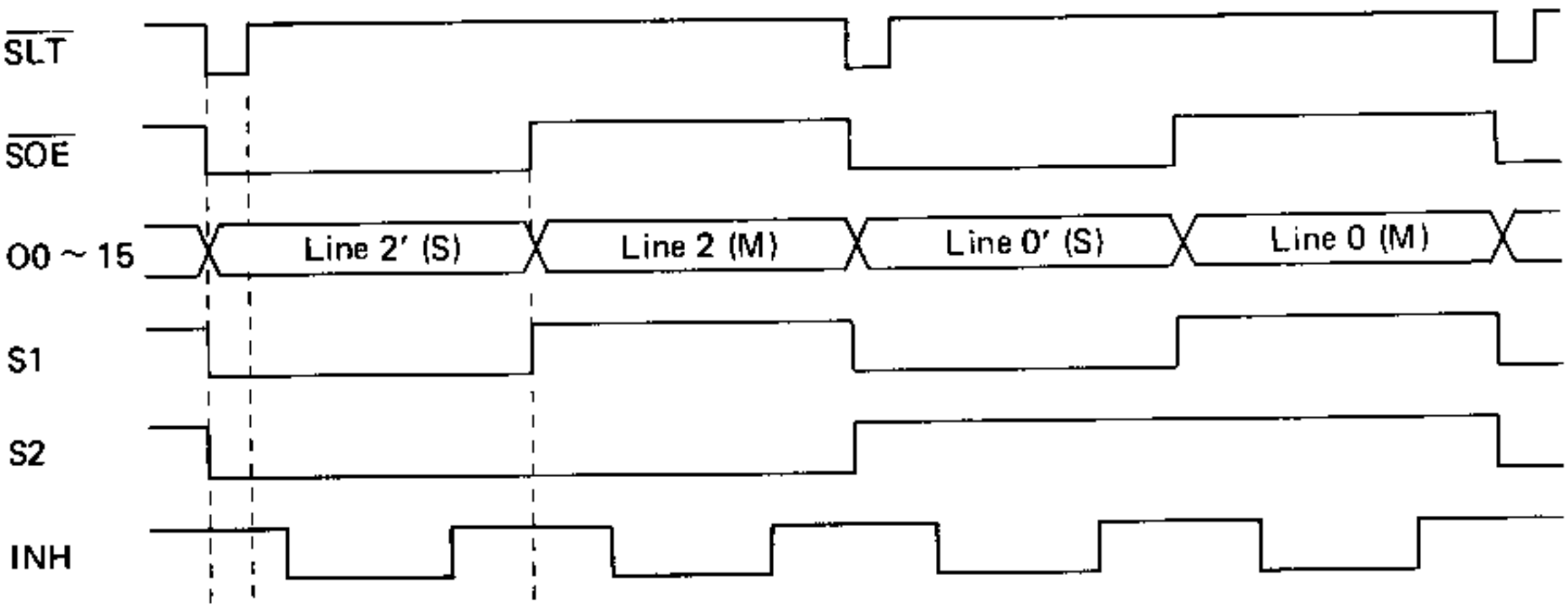


(2) Time Chart for Music LSI

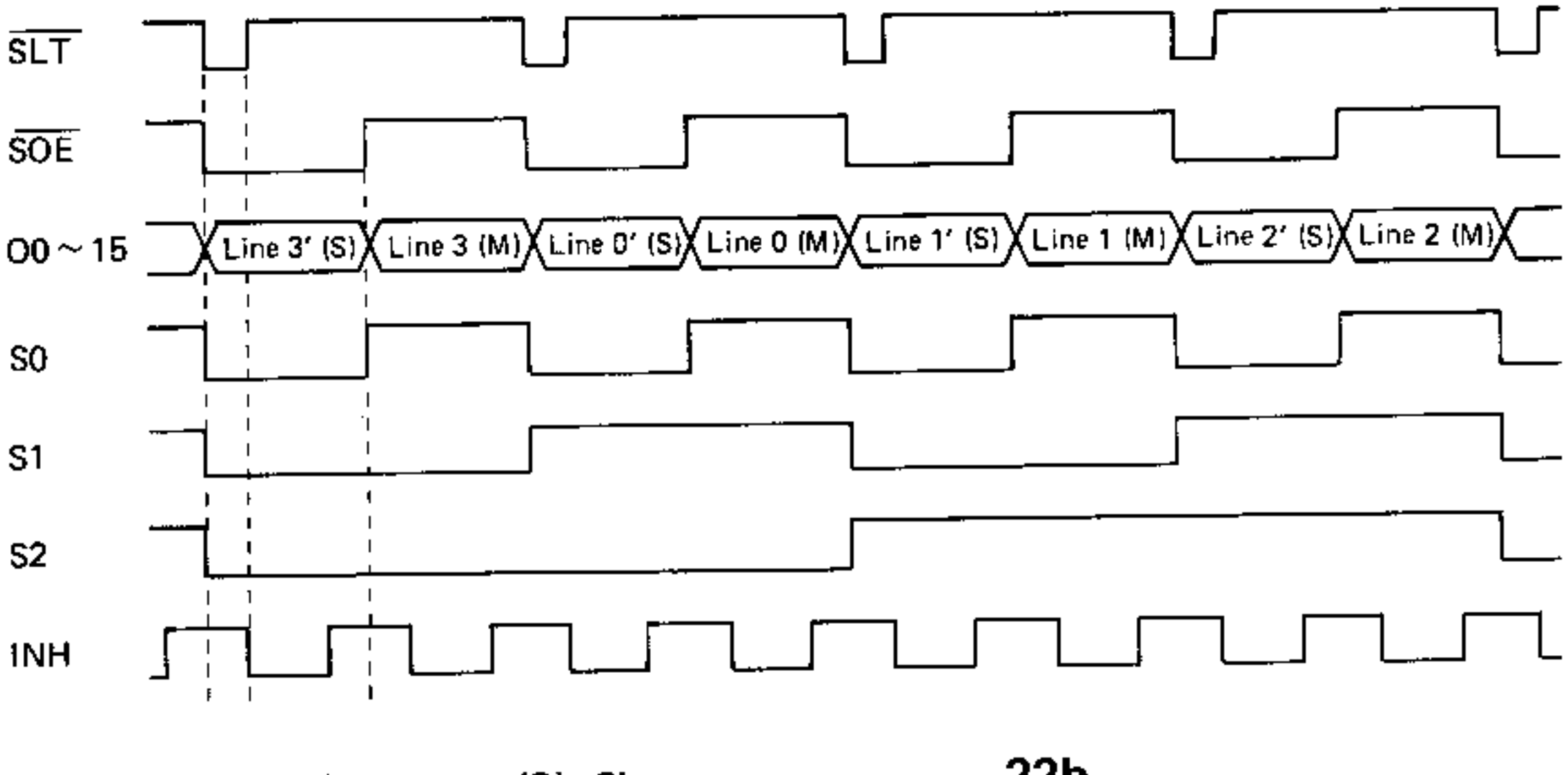
a) 2-Line mode (Terminal S0 and S1 are fixed at Low)



b) 4-Line mode (Terminal S0 is fixed at Low)



c) 8-Line mode



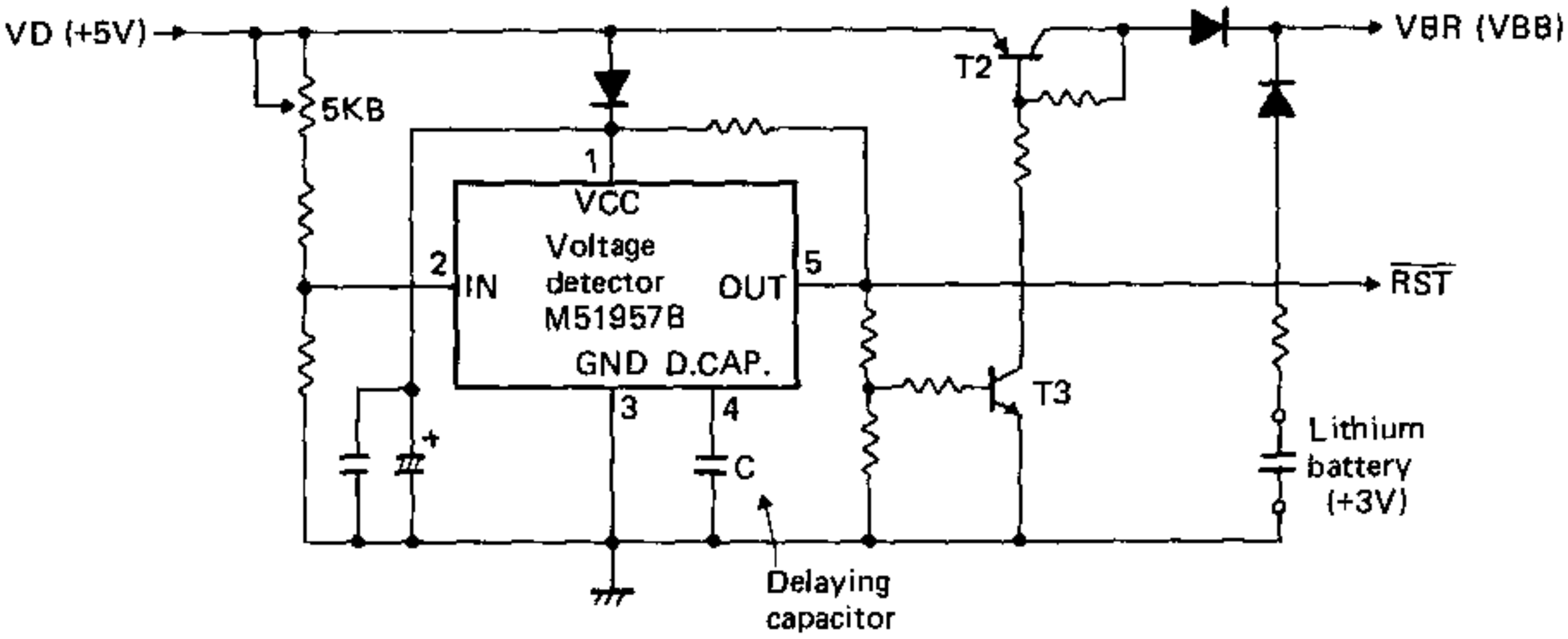
Note; (M): Master, (S): Slave

11-3. Music LSI (HD62013)

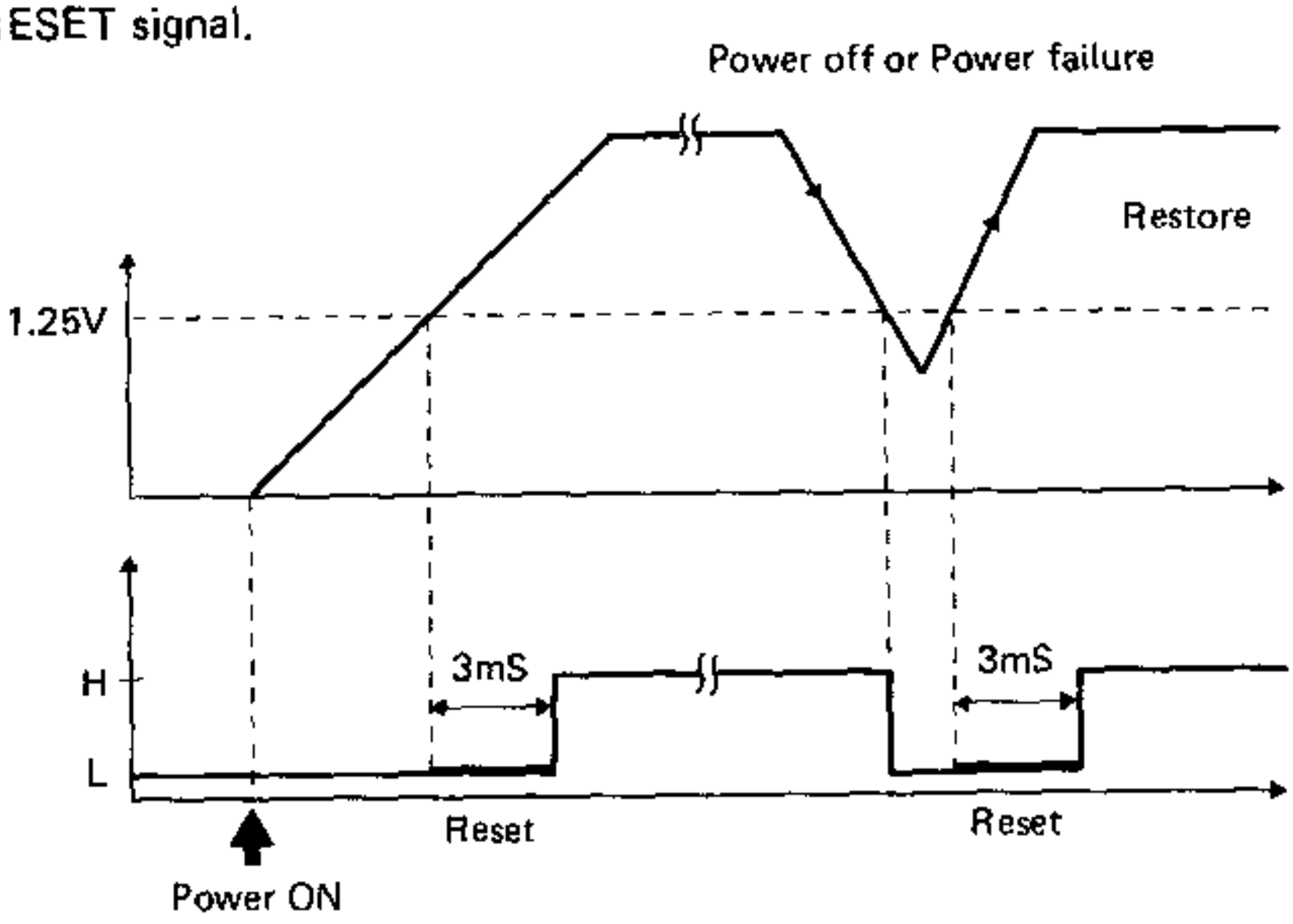
Pin No.	Terminal	Signal	In/Out	Function
1	GND3			Ground (0V) source
2~9	RD0~RD7	RD0 ~ RD7	In/Out	Data bus for work RAM
10~13	RA11 ~ RA8	RA11 ~ RA8	Out	Address bus for work RAM
14	$\overline{ROE}$		Out	Output enable signal for RAM. Low active.
15~22	RA7 ~ RA0	RA7 ~ RA0	Out	Address bus for work RAM.
23	$\overline{RWE}$		Out	Write enable signal for work RAM. Low active.
24	$\overline{RST}$	$\overline{RESET}$	In	When power switch is turned on, the terminal receives Low level signal for approximately 100mS during which the LSI internal circuit are reset.
25	VDD3			+5V source
26	CKIN		In	Clock pulse signal (10 MHz) input (Slave LSI only)
27	VDD1			+5V source
28, 29	OSC1, OSC2		In	Clock pulse signal (20 MHz) input (Master LSI only)
30	GND1			Ground (0V) source
31	CKSEL		In	Input clock pulse frequency selection terminal. Low .... 20MHz (Master LSI) High .... 10MHz (Slave LSI)
32	$\overline{M}$/S		In	Master/Slave selection terminal Low .... Master LSI High .... Slave LSI
33~38	NC			No connection
39~42	$\overline{SA1}$, $\overline{SA0}$ $\overline{SLT}$, $\overline{SOE}$	$\overline{SA1}$, $\overline{SA0}$ $\overline{SLT}$, $\overline{SOE}$	In/Out	Slave LSI control signals Master ... Out Slave .... In
43~46	S0 ~ S2 INH	S0 ~ S2 INH	Out	Multiplexer control signals (Master only)
47	VDD2			+5V source
48~63	O15~O4	BIT1~BIT16	Out	Digital sound data
64	GND2			Ground (0V) source
65	$\overline{I}$/D	A3	In	The LSI takes the data as an instruction or a data according to the status. Low .... Instruction High .... Data
66	$\overline{WS}$	$\overline{WR}$	In	Write signal for data bus. Low active.
67, 68				No connection
69~74	DB0 ~ DB5	D0 ~ D5	In	Data bus
75	CKOUT		Out	Clock pulse signal (10MHz) output (Master only)
76				Not used
77, 78	DB6, DB7	D6, D7	In	Data bus
79, 80	$\overline{CE2}$, CE1	$\overline{CS4}$, $\overline{CS5}$	In	Chip select signal. $\overline{CE2}$ ... Low active. $\overline{CS4}$ (Master), $\overline{CS5}$ (Slave) CE1 ... Fixed to High level

12. VOLTAGE DETECTOR (M51957B)

The circuit provides RAM's back-up voltage VBR (VBB) and a reset signal at power ON.
Also it detects voltage down of VD (+5V).



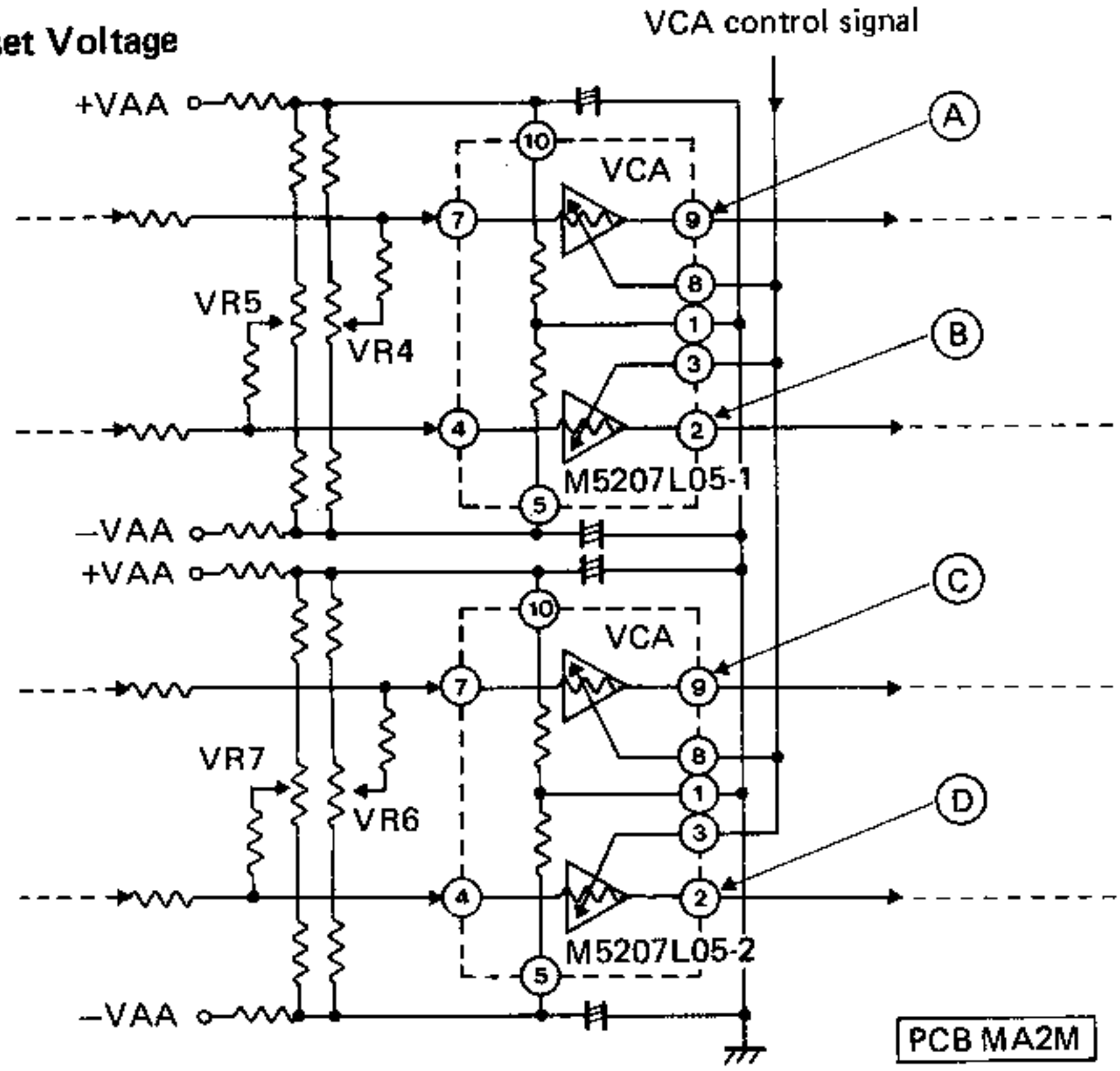
M51957B is a voltage detector. Pin 2 of M51957B receives a voltage that is devided from the VD (+5V) by the resistors.
At Power ON, pin 2 voltage rises gradually and, the IC becomes functional when pin 2 voltage rises gradually and, the IC becomes functional when pin 2 voltage is higher than 1.25V.
Pin 6 of M51957B stays Low level for three milliseconds after pin 2 becomes 1.25V and, during this period, the CPU is initialized.
Also, if the power voltage drops, pin 5 falls to Low level and CPU stops functioning by being Low of RESET signal.



While normal voltage is provided, transistors T2 and T3 turn on supplying voltage VBR to the RAMs.
When power OFF or a power failure is occurd, the transistors are turned off, the RAMs receive voltage VBR from the lithium battery.

13. ADJUSTMENTS

13-1. VCA Offset Voltage



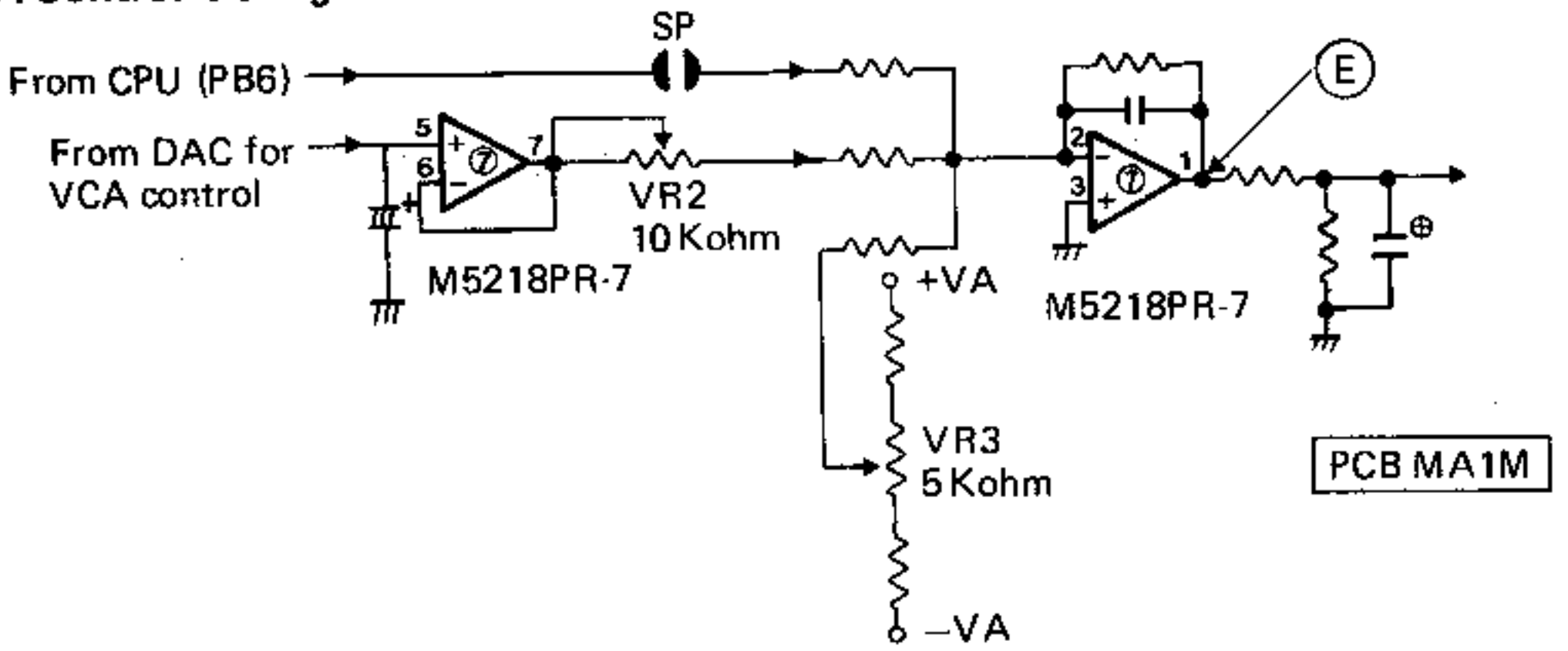
(1) Connect a voltmeter as indicated in the following table.
(Refer to checkpoints Ⓐ ~ Ⓓ on page 4)

Connection Point	VR to be adjust
Pin 9 and pin 1 (GND) of VCA M5207L05-1	VR4
Pin 2 and pin 1 (GND) of VCA M5207L05-1	VR5
Pin 9 and pin 1 (GND) of VCA M5207L05-2	VR6
Pin 2 and pin 1 (GND) of VCA M5207L05-2	VR7

(2) Set the main VR at maximum position.

(3) While the test unit is not producing any sound, adjust above VRs so that a voltmeter reading is **0 ± 3mV.**

13-2. VCA Control Voltage



(1) Connect a voltmeter on pin 1 and pin 3 (GND) to opam. (Refer to checkpoint Ⓔ on page 4)

(2) Set the main VR at maximum position.

(3) While the test unit is not producing any sound, adjust VR3 so that a voltmeter reading is **5V ± 0.05V.**

(4) Resolder short pad SP.

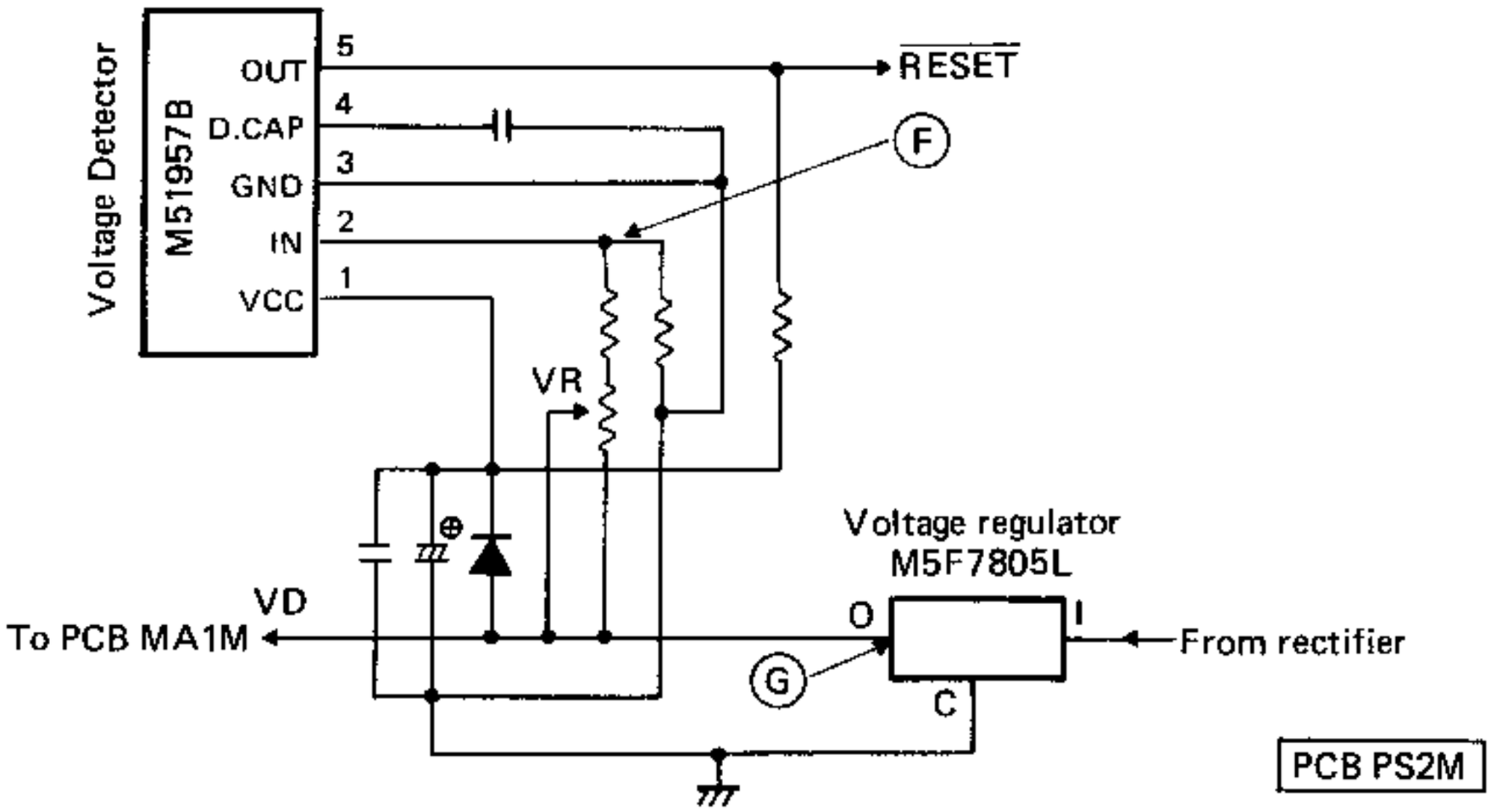
(5) Set the main VR at minimum position.

(6) While the test unit is not producing any sound, adjust VR2 so that a voltmeter reading is **0V ± 10mV.**

13-3. After Touch

Turn the VR1 on PCB MA1M all the way counter clockwise.

13-4. Power Down Detection Voltage



(1) Connecting an AC regulator to the test unit, adjust the AC regulator so that VD becomes **4.5V.** (Refer to checkpoint Ⓖ on page 3)

(2) Connect a voltmeter on pin 2 and pin 3 (GND) of voltage detector.
(Refer to checkpoint Ⓕ on page 3)

(3) While the test unit is not producing any sound, adjust VR so that a voltmeter reading is **1.25V $^{+10}_{-0}$mV.**

Main Features

1 Amazing Synthesis Versatility Thanks to Casio's All-new iPD Sound Source

Casio's all-new "Interactive Phase Distortion" (iPD) sound source system actually consists of 8 independent "modules" (M1 to M8). Each of these modules contains a DCO and a DCA, and is capable of generating independent waveforms. In the iPD system, the wave generated by any module can be used in either of two ways; to produce audible sounds or to modify waves generated by other modules.

The 8 iPD sound source modules work in associated pairs that are called "Internal Lines," or simply "lines." There are 4 internal lines - A, B, C and D.

The waveforms generated by both modules in any line can be used together in three different ways. They can be mixed, or one of the waveforms can be used to modulate the other for RING modulation or as the PHASE of a succeeding line.

2 Instant Recall of up to 256 Sounds and 256 Operation Memories.

64 presets give you a wide range of vocal versatility. And with the use of a standard ROM card, the VZ-1 gives you incredible tonal expansion potential - up to 128 patches and 128 keyboard setups are literally at your fingertips. What's more, you can store up to 64 sounds and 64 operation memories on an optional RAM card, for even greater freedom of timbral expression.

3 "Player-friendly" Menus and Functions

Virtually all of the VZ-1's editing and programming operations are organized into three basic sub-modes - Menu 1, Menu 2 and Menu 3 that feature a variety of "functions." Each of these functions is further broken down into "parameters," which are constants that have changeable values or settings. To alter VZ-1 sounds or programming, you simply alter the value of these parameters using a value slider or value keys.

4 Wide Backlit LCD Graphic Display

The VZ-1's wide graphic LCD features a hierarchical, "player friendly" menu structure, which allows speedy and accurate operations. Sound source configuration, patch editing, keyboard setup creation, output channel and MIDI specifications - in fact, virtually all VZ-1 operations are controlled by interacting with various functions that are found in the three VZ-1 menus. And a number of VZ-1 functions feature "graphic editing" capabilities.

5 Combination Mode Provides Layered and Split Voicing

The VZ-1's "Combination" mode lets you mix together up to 4 different patches in any of 8 different patch mix or patch split configurations. You can set effect and amp levels independently for each patch, and output them together through the MIX OUT channel. Or output the 4 patches through the VZ-1's L/R LINE OUT channels.

6 Multiple Control Wheels

In addition to a versatile, accurate pitch bend wheel, the VZ-1 features 2 user-assignable "Definable Wheels" for control of a wide range of modulation effects, including tremolo and vibrato. Definable Wheel 2 is "spring loaded," so that it returns to the OFF position automatically when it is released.

7 Inital Touch and After Touch for Greater Musical Expression

The VZ-1's responsive keyboard features both initial touch and after touch, for expanded expressive and dynamic control. With initial touch, you can control changes in pitch, timbre and volume according to key attack speed, while after touch gives you "playing-hand" control of amplitude and modulation contours. The VZ-1 - precise control of keyboard effects, with both hands still on the keyboard!

8 Velocity Split & Positional Cross Fade

The VZ-1 puts powerful multi-voice performance in your hands, with advanced features such as velocity split and positional cross fade. Set up multi-layered voices with up to 3 split points, and "fade" the voices into one another so there's no audible "split point" with the cross fade function, or control multiple voices through keyboard velocity using velocity split.

9 Key Follow Function

Casio's innovative key follow function lets you vary both DCO and DCA contours in accordance with the pitch of the key played on the keyboard. This function gives timbres a much more "natural" and realistic sound.

10 Multi-Channel MIDI Performance

The VZ-1 features Casio's exclusive multi-channel mode which can accept up to 8 timbres from separate MIDI sound sources. These can then be divided into constituent polyphonics and ensembled in any format you desire. Multi-timbral MIDI expansion, monophonic MIDI performance, or total 16-note MIDI polyphony can be selected.

11 Optional Foot Pedal (VP-10)

Choose an optional VP-10 for foot-pedal control of definable wheel functions.

12 Optional RAM Card (RA-500)

Choose an optional RA-500 RAM card for expanded sound storage and recall capabilities. Each RAM card holds up to 64 VZ-1 patches and 64 VZ-1 operation memories.

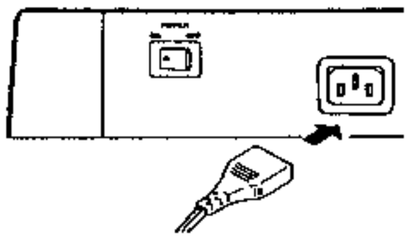
Plug In and Play!

A Quick Course in VZ-1 Performance

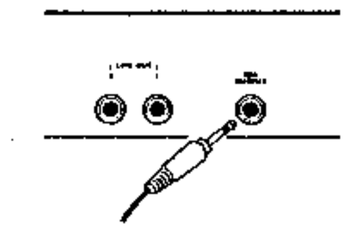
This section is provided for those users who want to "plug in and play" VZ-1 presets as soon as it's out of the box, and plan to study the details of the VZ-1's advanced operations later. It is intended to provide only the most basic information, so be sure to read the following sections of this manual once you've made some noise!

Once you've unpacked your new VZ-1, place it on a stable stand or surface.

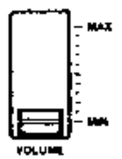
Make sure that the power switch on the back panel is turned OFF, and then connect the VZ-1's accessory power cord to an outlet with the proper voltage rating.



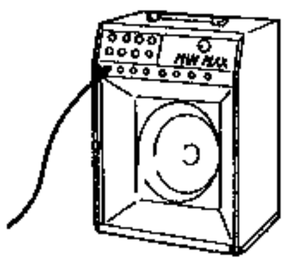
Next, connect the VZ-1's MIX OUTPUT channel to an amplifier with the accessory connecting cable. (There's no need to use an amplifier if you connect headphones to the headphone jack.)



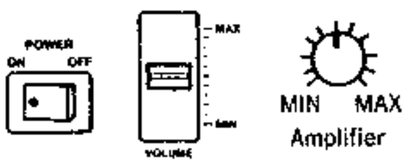
Adjust the VZ-1's volume level to MIN with the VOLUME slider.



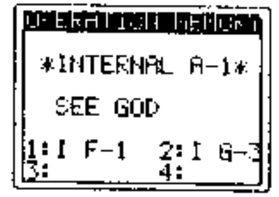
After making sure that the VZ-1 is connected to the amp, turn the amp's volume to MIN and then turn the amplifier on.



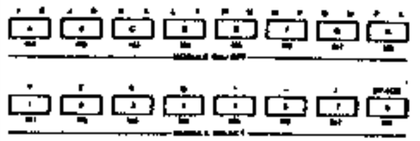
Now, turn ON the VZ-1 with the power switch on the rear panel and adjust both amplifier and VZ-1 volume levels appropriately.



Notice that when you turn ON the VZ-1, the first (A-1) onboard OPERATION MEMORY sound (SEE GOD) is selected.



Notice that this sound is identified by a letter and a number ("A" and "1"). In this state, you can select any of the 64 onboard OPERATION MEMORY sounds contained in the VZ-1 RAM memory by using the bank selectors (A through H) and number keys (1 through 8).



The sounds in the OPERATION MEMORY mode are "combined" sounds, which have been created using up to 4 different VZ-1 "patches."

Try playing a number of these sounds - how about H-5 - "BEAUTY/BEAST." Try playing this sound with a light touch and then a heavy touch. Now try pressing a key down hard after you've brought it to the end of its normal stroke. You're hearing just a few examples of the VZ-1's advanced performance capabilities. A variety of VZ-1 effects, keyboard split settings and velocity split settings are programmed in these OPERATION MEMORY sounds.

Ready to hear some individual patches? Just press the NORMAL key. You can now select from the 64 internal patches contained in the VZ-1 RAM memory. As with the OPERATION MEMORY sounds, you can select any of the 64 INTERNAL sounds contained in the VZ-1 RAM memory by using the bank selectors (A through H) and number keys (1 through 8)

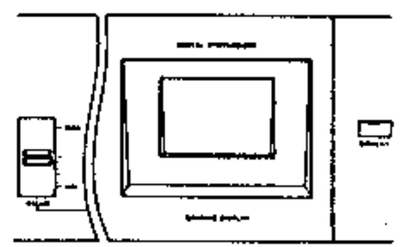
Try playing a number of these sounds as well - lead synth sounds? Try E-1 through E-6. Brass or strings sounds? Try any of the bank "B" sounds. For bass sounds, try D-1 through D-4. You'll be amazed at these realistic instrument sounds.

As you can tell by now, the VZ-1 features a wide range of useful instrument sounds and effects. But that's only the beginning. It's a powerful synthesizer that lets you create and instantly recall up to 256 sounds and keyboard setups for unmatched sonic and performance versatility.

To make full use of the VZ-1's power sound synthesis capabilities, be sure to read the remaining sections of this manual.

* To adjust graphic display brightness

The VZ-1's liquid crystal graphic display can be adjusted to various degrees of brightness for clear viewing under virtually any lighting condition. To adjust display brightness, hold down the DISPLAY key and move the VALUE slider.



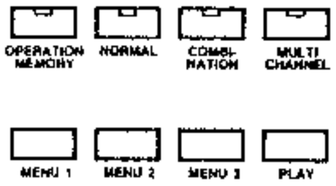
VZ-1 Theory: Flow of Operations

Although the VZ-1 features an extremely complex operating system, it has been designed so that actual operations are quite simple - after a few hours you'll be amazed at how simple the VZ-1 is to operate, and how versatile it is.
In order to appreciate the beauty of the VZ-1, it's important to have a clear initial understanding of its basic "flow of operations" - in other words the basic order of operations you will probably want to follow to make the most of the VZ-1.

Simply speaking, VZ-1 operations can be divided into four different "modes" - which, as you might expect, correspond to the four modes listed on the front panel of the VZ-1 - the **NORMAL** mode, the **COMBINATION** mode, the **OPERATION MEMORY** mode, and the **MULTI CHANNEL** mode.

You can select a MODE by pressing the corresponding mode key, and then select any MENU (or the PLAY sub-mode) with the MENU keys (or PLAY key).

For a clear understanding of each, take a few moments to read through the following text.



NORMAL MODE

The NORMAL mode is what you might think of if you've used a "normal" single-patch synthesizer that does not feature the extensive sound layering and memory capabilities of the VZ-1.

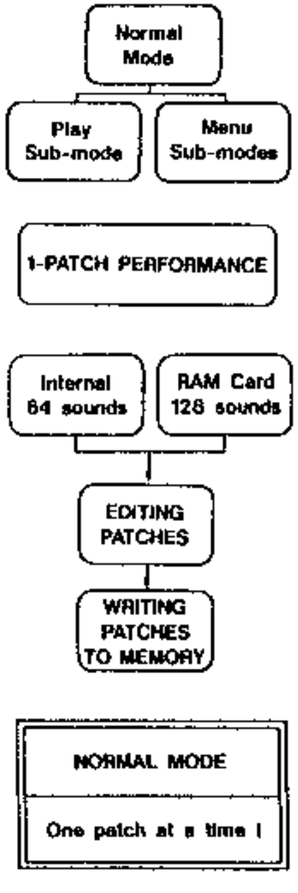
The NORMAL mode can be further broken down into two **sub-modes** - the **PLAY** mode and **MENU** mode. The PLAY mode is selected for normal performance, while the MENU mode(s) is selected for further editing of sound and effect data. In the **PLAY** sub-mode, you can freely choose any one of the VZ-1's 64 preset sounds or RAM card sounds, edit it, and use it in performance.

The NORMAL mode is the basic performance mode, where "patches" created through the VZ-1's modular sound source system can be selected and output individually for 1-patch performance. You can make use of the wide range of VZ-1 sound effects in this mode, for expanded performance versatility.

You can also use the NORMAL mode to create new patches by altering values for existing patches and writing them in either the internal or card memory. Or create entirely new sounds by initializing a memory area and programming values from "scratch" (initialized data).

Once you've created sounds you want to save, you can write them to one of 64 internal memory areas in the NORMAL mode, or to an optional RAM card which holds as many as 128 sounds.

One important thing to remember when you select the NORMAL mode is that you're working with **only 1 patch at a time** - you can recall one patch at a time, edit one patch at a time, perform with one patch at a time, and write an individual patch to memory.



COMBINATION MODE

The COMBINATION mode is a **"buffer"** (for those with computer experience), or **"work area"** where you can "combine" the patches you've created in the NORMAL mode to make detailed, multi-timbral keyboard setups featuring keyboard split point, velocity split specifications, and individual effect specifications for each patch in the setup.

The COMBINATION mode can be further broken down into two **sub-modes** - the **PLAY** sub-mode and **MENU** sub-modes.

The PLAY sub-mode is selected for normal performance, while the MENU sub-modes are selected for further editing of sound, effect, and keyboard setup data.

In this work area, you can select up to 4 different patches created in the NORMAL mode (preset, or those you've created), and arrange them freely to create a multi-timbral keyboard setup. The "arrangement" of these sounds is accomplished by choosing from any of 8 different KEY ASSIGN settings, which feature both SPLIT and LAYERED patch arrangements.

A variety of VZ-1 functions can be used to determine keyboard split points, as well as velocity split for each patch in the sound.

Effects can also be set individually for each patch in this mode. What's more, relative amplitude levels can be set for each patch, allowing total control of "balance" within the multi-patch sound.

The VZ-1 is designed so that you can quickly and conveniently arrange the patches you use in the multi-patch sound - if you don't like what you hear, you can choose a replacement patch or delete it from the sound altogether.

One important thing to remember when you select the COMBINATION mode is that you're working with **up to 4 patches at a time.** Another important point is that the COMBINATION mode is only a "work area," where you can "work" on one "combined" (multi-patch) sound at a time.

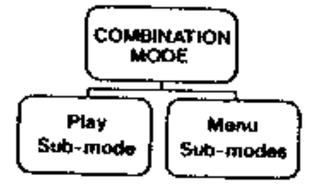
OPERATION MEMORY MODE

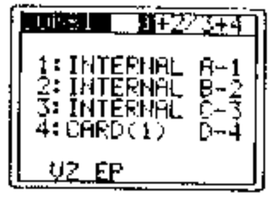
Once you've created a sound you want to save - an individual patch in the NORMAL mode (in internal or card memory) or a combined sound in the COMBINATION mode, you can write them to one of 64 built-in Operation Memories.

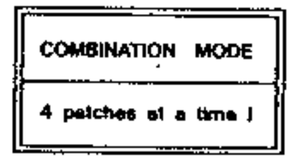
The **OPERATION MEMORY** mode is used to memorize and recall not only the individual patches and combined sounds created in the first two modes, it also holds sound-related details of effect and control panel settings. This is where you "store" the keyboard setups and patches you've created, for instant recall during performance.

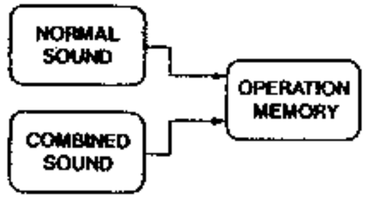
This mode is actually used in concurrence with the NORMAL and COMBINATION modes, as it stores and recalls data which have been created in them.

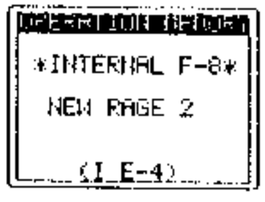
The OPERATION MEMORY mode can be further broken down into **sub-modes** - the **PLAY** sub-mode and **MENU** sub-modes. The PLAY mode is selected for normal performance, while the MENU modes are selected for further editing of sound and effect data in the selected operation memory.

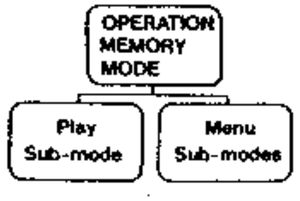












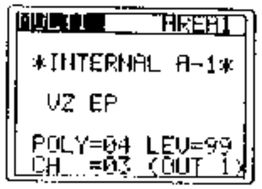
MULTI CHANNEL MODE

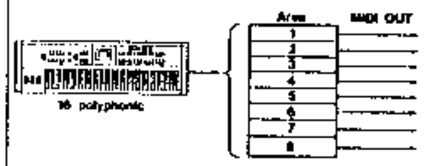
The **MULTI CHANNEL** mode is basically a performance mode, which makes advanced use of MIDI - the Musical Instrument Digital Interface.

The VZ-1 is capable of receiving MIDI performance messages in a number of ways; (1) With 16-note polyphony, wherein all notes and performance data transferred using the same MIDI channel (MIDI mode 3-omni off/poly), and (2) With 8-note polyphony, wherein each of the MIDI "Multi-Channel Area 1-4 or 5-8" is assigned an individual, independent timbre with 2-note polyphony.

Each AREA can be assigned an independent sound, a polyphonic value (maximum number of note which may sound at one time for the specified area), output level, and the MIDI Send/Receive channel number.

Through this operation, you can freely set up to 8 polyphonic MIDI channels, however it's important to remember that the VZ-1 polyphony remains unchanged - 16 notes maximum. Because of this, the sum polyphonic value for all 8 Multi Areas is - drum roll please - "16."



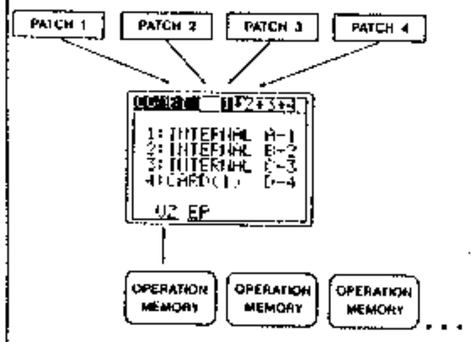


Now that you understand the basic theory of VZ-1 operations, the "BIG" picture becomes clearer;

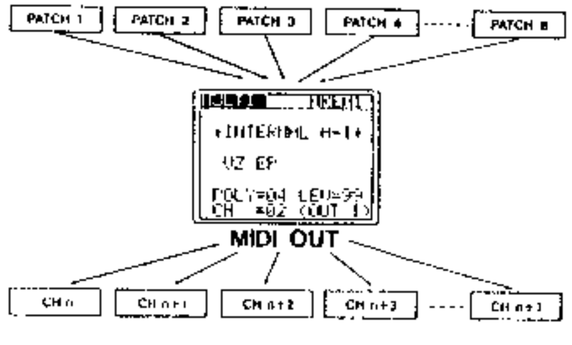
1 —Write, edit and recall individual patches using the **NORMAL** mode.

2 —"Combine" patches to make multi-timbral keyboard setups (combined sounds) in the **COMBINATION** mode. (Remember that you can write and edit patches individually as in the NORMAL mode as well.)

3 —Write patches and combined sounds to any of 64 operation memories and recall them for performance in the **OPERATION MEMORY** mode.



4 —Create up to 8 polyphonic MIDI "Multi Areas" in the **MULTI CHANNEL** mode.



VZ-1 Theory: iPD Modular Sound System

At the heart of the VZ-1's amazing sound synthesis capabilities is an all-new "iPD" (interactive Phase Distortion) sound source. In order to get the most out of your VZ-1, it is vitally important that you understand at least the basic theory behind this new sound source.

MODULES

The iPD sound source system actually consists of 8 independent modules (M1 to M8).

Each module contains a DCO and a DCA, and is capable of generating independent waveforms. (①) If you're familiar with analog synthesis, you can think of the modules as oscillators with controls. In the iPD system, the wave generated by any module can be used in either of two ways;

1 - to produce audible sounds
2 - to modify waves generated by other modules

LINES

Generally speaking, the 8 sound source modules work in associated pairs that are called "**Internal Lines**," or simply "lines." There are 4 internal lines - A, B, C and D, as shown to the right. (②)

The waveforms generated by both modules in any line can be used together in three different ways. The waveforms can be mixed, or one of the waveforms can be used to modulate the other for RING modulation or PHASE, as diagrammed at the right. (③)

To show how the modules in each line are interrelated, let's analyze the relationship between the two modules which make up LINE A.

LINE A consists of two different modules - M1 and M2. While these modules are entirely independent and generate totally independent waveforms, they can be utilized together in any of three different output formats - **MIX** (mixed output), **RING** (ring modulation) and **PHASE** (phase).

MIXED WAVEFORM OUTPUT

When MIX is selected, the waveforms generated by M1 and M2 are output together, according to the formula given below. (④)

MIX: M1 + M2

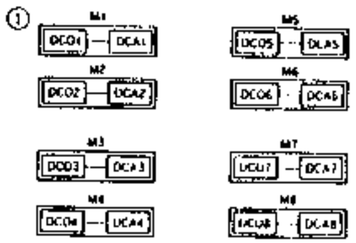
This may look a bit complex at first, but it's really not. It may be easiest to think of M1 and M2 as individual oscillators (which they are). In the MIX format, both of these oscillators sound together.

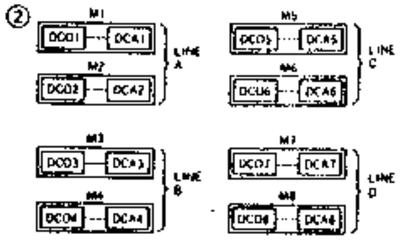
RING MODULATION

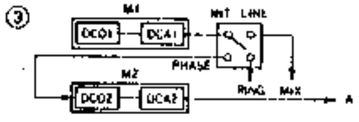
These same two waveforms can also be output using RING MODULATION, which is created according to the formula shown below. (⑤)

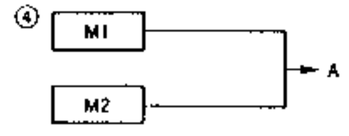
RING MOD: M2 + M2 × M1

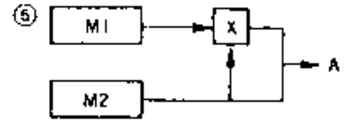
You've probably heard ring modulation - even if you don't recognize the term. Typically, it creates a "clangorous" or metallic sound and is often used in synthesizing gongs, bells and other ringing percussive sounds.











PHASE
The 2 waveforms in LINE A (M1 and M2) can also be output using PHASE, according to the formula shown below. (⑥)

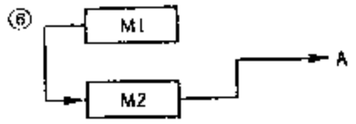
PHASE: M2(M1)

In this format, only one oscillator is heard, as one oscillator is used to modulate the other. In this case, M2 is produced using M1 as the phase to "read" the M2 waveform.

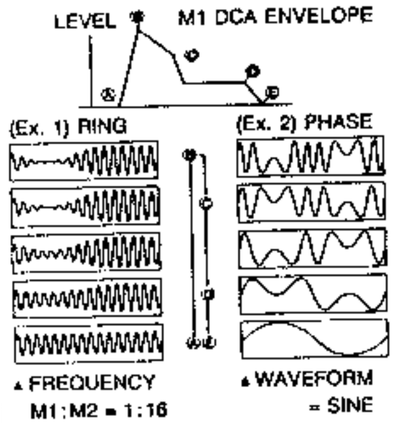
The degree of RING and PHASE effect is dependent on the amplifier (DCA) envelope of related modules. (In addition, to amp envelope, the degree of changes in sound (waveform) are affected by amp envelope-related parameters such as key Follow, Velocity, etc.) (⑦)

Naturally, these same functions and formulas apply to all 4 internal lines - LINE A, LINE B, LINE C and LINE D. And they can be used to modify the other Internal Lines through **External Phase** processing.

⑥



⑦ Diagram of relationship between DCA ENVELOPE and timbre.



External Phase
When the External Phase format is selected, the line output of the two modules (M1 and M2 in our example) is used as the phase of the second module in the succeeding internal line - M4 in LINE B, in our example. (⑧)

Now that you have a basic grasp of how the system is organized, you can start to imagine just how versatile the VZ-1 actually is. Because of the relationships between the sound source modules, you can create patches which contain independent sounds from each module, or use modules to modulate other modules. Theoretically, you can actually use modules 1 through 7 to modulate module 8, so that the only sound you actually hear is output through module 8!

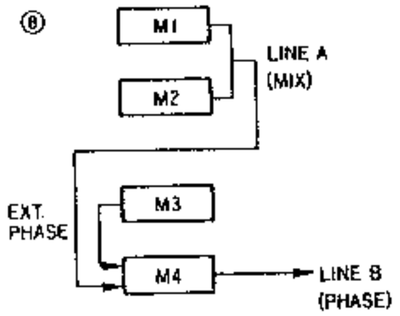
To illustrate this more closely, take a look at the following examples.

(EXAMPLE 1)
In this state the internal line of both LINEs A and B are set to MIX - i.e. the waveforms of both modules in each line are output "mixed" together, as shown on the display. (⑨) (⑩)

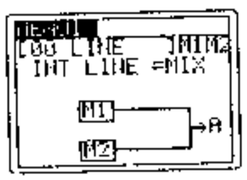
If, in this state, EXTERNAL PHASE from LINE A is specified, the display changes to that shown on the right, and the resulting waveform can be output from LINE A. (⑪)

Remember that LINEs which are used as external phase do not sound - they simply become the phase of the succeeding line. In our example, LINE A does not sound, but becomes the phase of LINE B.

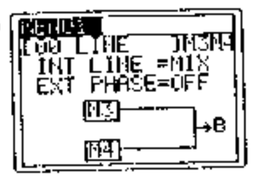
⑧



⑨



⑩



⑪

(EXAMPLE 2)
In this state, the internal line of LINE A is set to MIX, while LINE B is set to PHASE - i.e. M3 becomes the phase of M4. (⑫)

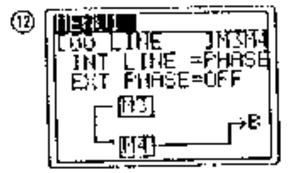
If, in this state, EXTERNAL PHASE from LINE A is specified, the display changes to that shown on the right, and the resulting waveform can be output through LINE B. Once again, LINE A does not sound, but is used only as the phase of LINE B. (⑬)

To make this a bit clearer, think of how a guitar player uses preamp stages to create distortion. With only one volume control, the guitarist must be VERY LOUD to overdrive his amp and get a warm, distorted sound. However if he adds a preamp or has a master volume control, he can overdrive his amp and still maintain a reasonable volume level. (⑭)

By linking more amplifiers, the guitarist could theoretically create an incredible singing "buzz", as the distortion can be compounded with each volume control. (⑮)

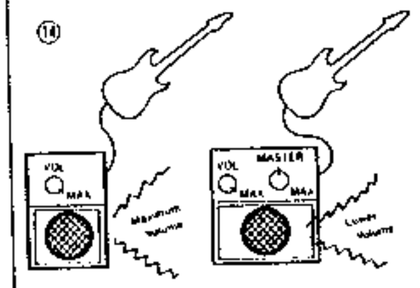
The VZ-1 modules work much in the same way - with only one oscillator you can produce only one sound. But with 8 independent oscillators, you can create patches with varying degrees of complexity - using the oscillators together to create a "fat" layered patch consisting of sounds from all 8 modulators, or to create an individual sound output from a single oscillator with a "chain" of modulation stretching from M8 all the way back to M1. In essence, the modules used to create modulation are "overdriving" the output modules. (⑯)

⑫

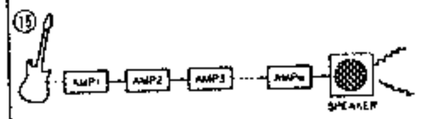


⑬

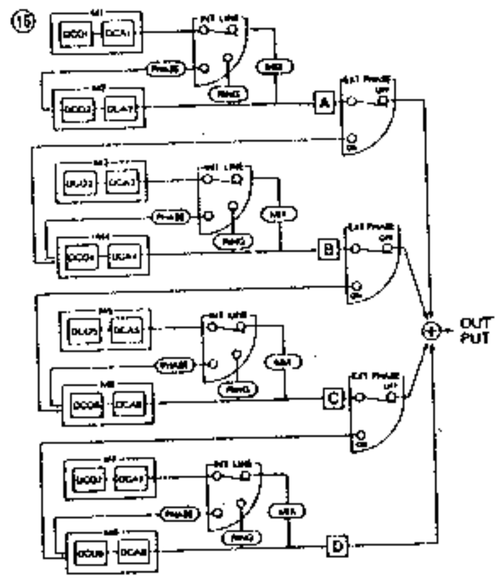
⑭



⑮



⑯



The VZ-1 lets you use all 8 modules entirely independently - using combinations of MIX, RING and PHASE output from each LINE to create a complex sonic matrix which is called a "patch". Once again, remember that a "patch" is simply the completed tone data coming from modules 1 through 8. Or, in simpler terms, an individual "sound" being output from the VZ-1.
The number of possible combinations used to create a patch boggles the mind, when you consider the versatility of the control parameters which are used to shape the waveform being output from each module. (⑰)

⑰

MODULE	EXT PHASE	INT LINE	LINE A~D
M1 M2		MIX	A=M1+M2
		RING	A=M2+M1×M2
		PHASE	A=M2(M1)
M3 M4	OFF	MIX	B=M3+M4
		RING	B=M4+M3×M4
		PHASE	B=M4(M3)
	ON	MIX	B=M3+M4(A)
		RING	B=M4(A)+M3×M4(A)
		PHASE	B=M4(M3+A)
M5 M6	OFF	MIX	C=M5+M6
		RING	C=M6+M5×M6
		PHASE	C=M6(M5)
	ON	MIX	C=M5+M6(B)
		RING	C=M6(B)+M5×M6(B)
		PHASE	C=M6(M5+B)
M7 M8	OFF	MIX	D=M7+M8
		RING	D=M8+M7×M8
		PHASE	D=M8(M7)
	ON	MIX	D=M7+M8(C)
		RING	D=M8(C)+M7×M8(C)
		PHASE	D=M8(M7+C)

Operating System Controls

In some ways, your VZ-1 is very similar to a computer, as it is capable of storing and generating a large amount of digital sound data. This "data processing" is maintained by the VZ-1 "Operating System," which you can think of as a collection of system programs that control the overall operation of the VZ-1.

The main interface with the VZ-1 operating system can be found in the menu functions which can be called up on the VZ-1's built-in graphic display. These functions contain a number of parameters, which determine the various characteristics of VZ-1 sounds. In fact, sound synthesis on the VZ-1 basically consists of inputting values for these parameters.

With a computer, you generally enter a certain program, and use a cursor to move to different positions in the displayed page, and use the keyboard to input commands, values, text, etc. (this is, of course a simplified explanation.)

The VZ-1 works much in the same way, and it features a number of basic "Operating System Controls" which are used to perform the same functions a computer keyboard or mouse would perform.

Take a look at the MENUs listed on the front panel of the VZ-1 - this "menu hierarchy" gives you a bird's-eye view of how VZ-1 MENUs and FUNCTIONs are organized. Notice that these menus are divided into sections, with the relative MODEs listed on the left, and the various FUNCTIONs on the right.

MENU 1		PARAMETER
NORMAL COMBINATION	DCO	00 LINE
		01 WAVE FORM
		02 DETUNE
		03 ENVELOPE
		04 ENV DEPTH
		05 KF LEVEL
		06 VEL LEVEL
		07 VIBRATO
		08 OCTAVE
	DCA	09 ENVELOPE
		10 ENV DEPTH
		11 KF LEVEL
		12 VEL LEVEL
		13 TREMOLO
		14 AMP SENS
		15 TOTAL LEVEL
	DCO/DCA	16 KF RATE
		17 VEL RATE
		18 VOICE NAME

MENU 2		EFFECT
OPERATION MEMORY NORMAL COMBINATION MULTI CHANNEL	00	OPERATION NAME
	01	PORTAMENTO/GOLD
	02	PITCH BEND
	03	AFTER TOUCH
	04	DEF WHEEL 1
	05	DEF WHEEL 2
	06	FOOT VR
COMBINATION	07	LEVEL
	08	PITCH
	09	SPLIT POINT
	10	SUSTAIN PEDAL
	11	VEL SPLIT
	12	VEL INVERSE
	13	POS CROSSFADE
	14	DELAY TRIG
	15	VIBRATO INV
	16	TREMOLO INV
	17	COMBI COPY
MULTI CHANNEL	16	PITCH

MENU 3		TOTAL CONTROL
OPERATION MEMORY	00	TUNE/TRANSPOSE
	01	MEMORY PROTECT
NORMAL	02	SAVE/LOAD
COMBINATION	03	MIDI CHANNEL
	04	MIDI DATA
MULTI CHANNEL	05	PITCH BEND
	06	CARD FORMAT
NORMAL	07	PRESET CALL

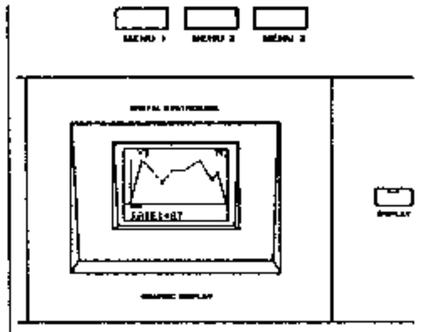
To work in the VZ-1 operating system, you first choose what **MODE** you want to work in, by pressing one of the MODE keys.

After you've selected the mode, you must specify what **MENU** you want to enter, by pressing one of the MENU keys.

Now that you've specified the MODE and MENU, choose the **FUNCTION** containing the parameters that you want to access by using the VALUE controls - either the Value Slider or the Value (YES/NO) keys.

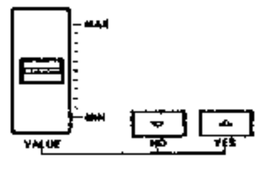
With some functions, you'll notice a module indicator at the top right-hand corner of the display. These indicators appear only when the selected function is set for each sound source module. To select the module you want to edit, you simply press the corresponding **MODULE SELECTOR**.

When you've moved to the desired function and selected the module you want to edit, you can access the parameters by pressing the related **MENU** key once again. With this, you've "accessed" the parameters contained in the function, and are now free to move through them with the cursor keys. In cases where functions feature graphic editing capabilities, you can move automatically into graphic editing without pressing the MENU key by pressing the DISPLAY key.

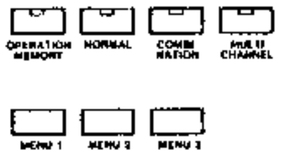


To move through the various PARAMETERS contained in any function, you use the CURSOR keys. These keys let you move up or down, and right or left in the lower section of the menu.

Once you've moved to a parameter which you want to set or edit with the cursor, you can use the VALUE controls to input values. Use the slider to input approximate values, and the value keys to make more exact value specifications.



When you want to exit from any function, menu or mode, you can simply press any of the MODE or MENU keys. Notice that when you reselect a particular MENU (MENU 1, for example), the function you last selected in that MENU is automatically recalled.



Difficult? Not at all! If it's not entirely clear, try going through the practice exercise found. It will familiarize you with the "Operating System Controls" - the controls used to "communicate" with the VZ-1 operating system.

Menus and Functions

Within each VZ-1 Menu you will find a number of "Functions." Each of these functions is further broken down into "parameters," which are constants that have changeable values or settings.

For example, in MENU 1, you can select from a variety of functions which affect the characteristics of the sound produced by each individual module (oscillator). To alter the characteristics of the sound, you simply alter the values of the various parameters contained in each MENU 1 function.

MENU 1		PARAMETER
NORMAL COMBINATION	DCO	00 LINE
		01 WAVE FORM
		02 DETUNE
		03 ENVELOPE
		04 ENV DEPTH
		05 KF LEVEL
		06 VEL LEVEL
		07 VIBRATO
		08 OCTAVE
	DCA	09 ENVELOPE
		10 ENV DEPTH
		11 KF LEVEL
		12 VEL LEVEL
		13 TREMOLO
		14 AMP SENS
		15 TOTAL LEVEL
	DCO/DCA	16 KF RATE
		17 VEL RATE
		18 VOICE NAME

In MENU 2, you can select from a variety of functions which control the VZ-1's built-in sound effects. To alter the way that sounds are affected by these effects, you simply alter the values of the various parameters contained in each MENU 2 function.

MENU 2	EFFECT	
OPERATION MEMORY	00	OPERATION NAME
NORMAL COMBINATION MULTI CHANNEL	01	PORTAMENTO/SOLO
	02	PITCH BEND
	03	AFTER TOUCH
	04	DEF WHEEL 1
	05	DEF WHEEL 2
	06	FOOT VR
COMBINATION	07	LEVEL
	08	PITCH
	09	SPLIT POINT
	10	SUSTAIN PEDAL
	11	VEL SPLIT
	12	VEL INVERSE
	13	POS CROSSFADE
	14	DELAY TRIG
	15	VIBRATO INV
	16	TREMOLO INV
	17	COMBI COPY
MULTI CHANNEL	18	PITCH

In MENU 3, you can select from a variety of functions which control VZ-1 performance. These are known as "total control" functions, and include such parameters as keyboard tuning, MIDI settings, etc.

MENU 3		TOTAL CONTROL
OPERATION MEMORY NORMAL COMBINATION MULTI CHANNEL	00	TUNE/TRANSPOSE
	01	MEMORY PROTECT
	02	SAVE/LOAD
	03	MIDI CHANNEL
	04	MIDI DATA
	05	PITCH BEND
	06	CARD FORMAT
NORMAL	07	PRESET CALL

Take a look at the MENUs listed on the front panel of the VZ-1 - this "menu hierarchy" gives you a clear view of how VZ-1 MENUs and FUNCTIONs are organized.

MENU 1 — SOUND EDITING FUNCTIONS
MENU 2 — EFFECT-RELATED FUNCTIONS
MENU 3 — TOTAL CONTROL FUNCTIONS

It's important to remember that not all FUNCTIONs can be accessed in every MODE - notice that the menus are divided into sections, with the relative MODEs listed on the left. Remember that when you choose a particular function, the related operational mode must first be specified. You'll also notice that each FUNCTION INDEX lists the operational modes in which the function operates.

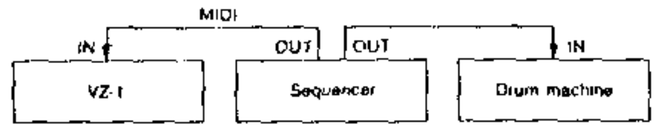
VZ-1 Important Terms

Throughout this manual you will encounter terms (words) which you may - or may not - be familiar with. Before jumping into VZ-1 operations, it's important to make sure that you understand the basic usage of these terms in this manual. Take a few moments to read through these words and become familiar with them - you'll find it will enhance your overall understanding of the VZ-1.

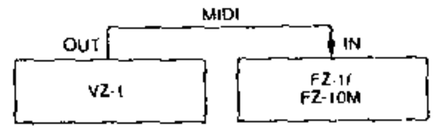
MENU	A displayed list of the various FUNCTIONS you can select to perform on the VZ-1. The VZ-1 features three basic Menus.
FUNCTION	Any of the items listed on the VZ-1 menus. Each Function contains a variety of PARAMETERS, and is identified by a two-digit number. For example, Function 02 in Menu 1 contains parameters related to detuning.
PARAMETER	A constant control which features variable levels. These parameters control not only data that affects the various components of a sound, but also aspects of the overall keyboard setup.
VALUE	The level or setting assigned to an individual parameter.
MODULE	The VZ-1's tPD sound source features 8 independent "modules." These can be thought of as independent - but interrelated - oscillators with controls.
INTERNAL LINE	Sound source MODULES work together in "pairs." These pairs form what is known as an INTERNAL LINE, or simply "line." For example, Module 1 and Module 2 (M1 and M2) form Internal Line A - known in this manual as LINE A. M3 and M4 form LINE B, etc.
EXTERNAL PHASE	In addition to using the output of any LINE to create an audible sound, the VZ-1 lets you utilize the output of any LINE to modulate the succeeding line. For example, the output of LINE A can be used to modulate LINE B. This configuration is known as an "External Phase."
PATCH	With analog synthesizers, a "patch" literally referred to the way in which various synthesizer blocks or modules were hard-wired (hooked up). With digital synthesizers, this term has come to refer to completed sound data which can be output by the synthesizer. In this manual, you can think of "patch" as referring to **any completed sound data coming from modules 1 through 8.**
OPERATION MEMORY	An operation memory is literally a full keyboard setup, including specifications for multiple patches (when desired), keyboard and velocity split, MIDI specifications, etc. The VZ-1 features 64 operation memories which allow onboard storage of up to 64 different keyboard setups.
ENVELOPE	A voltage which changes as a function of time. Envelopes are generally triggered by controllers, and are used to shape the amplitude (volume) and pitch of a note.

MIDI - Musical Instrument Digital Interface

The VZ-1 is equipped with MIDI - the Musical Instrument Digital Interface. This is an industry-standard interface that allows you to connect the VZ-1 to other MIDI-equipped electronic musical instruments, drum and rhythm machines, sequencers, and even personal computers.



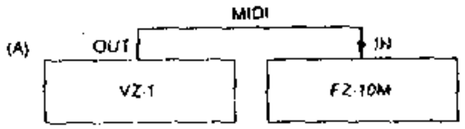
The VZ-1 can be connected to other instruments in a variety of configurations. For example, you can take advantage of advanced sampling capabilities by connecting the VZ-1 to a Casio FZ-1/FZ-10M Digital Sampling Synthesizer).



On the VZ-1, MIDI-related settings are made using the MIDI CHANNEL and MIDI DATA functions found in MENU 3 (MENU 3-03 and MENU 3-04.) For details on how to set MIDI-related parameters, refer to the corresponding function indexes.

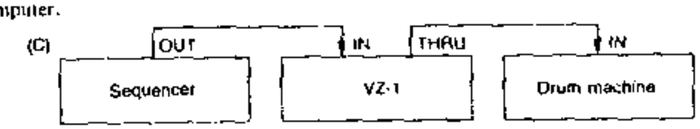
Examples of MIDI Application

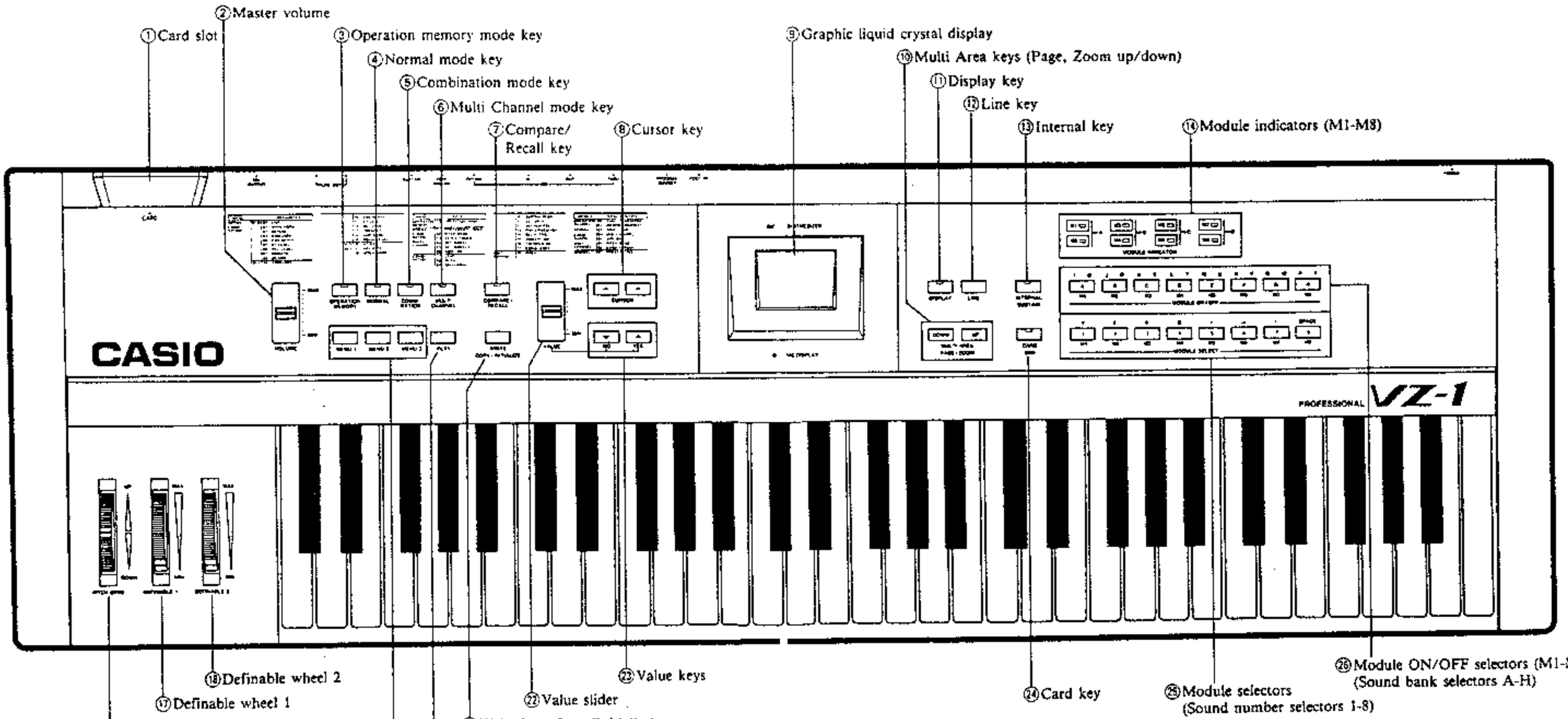
(1)In configuration A, the VZ-1 can be used as a master keyboard to control another MIDI sound source (such as the FZ-10M). You can use the VZ-1 keyboard to control only FZ-10M sounds, or play sounds from both sound sources in synch.

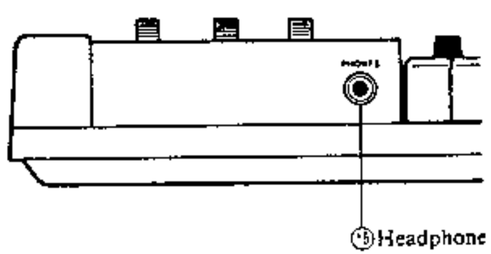


(2)In configuration B, the VZ-1 can be used as a slave, being driven by another MIDI device such as a drum machine.

(3)In a MIDI chain setup, such as configuration C, multiple MIDI devices can be controlled by a master controller such as a master keyboard, sequencer or even a personal computer.







①Card slot
Insert ROM or RAM cards for save/load of sound data. With a ROM card, up to 128 individual patches and 128 operation memories can be stored. RAM cards allow storage of up to 64 patches and 64 operation memories.

②Master volume
Used to adjust the overall output volume of the VZ-1.

③Operation memory mode key
Used to select the OPERATION MEMORY operational mode.

④Normal mode key
Used to select the NORMAL operational mode.

⑤Combination mode key
Used to select the COMBINATION operational mode.

⑥Multi Channel mode key
Used to select the MULTI CHANNEL operational mode.

⑦Compare/Recall key
Used during editing to "recall" the original sound (sound before editing) and "compare" it with the edited version. When the indicator is OFF or flashing, the original sound is output. When the indicator is ON, the edited version is output.

⑧Cursor key
Used to move the "cursor" within the various VZ-1 menu functions.

⑨Graphic liquid crystal display
Wide 64×96 dot backlit liquid crystal graphic display is used to display all VZ-1 menu functions. Many functions can be programmed/edited "graphically," as this display provides graphic representations of sound waveforms, envelopes, etc.

⑩Multi Area keys (Page, Zoom up/down)
Used to access display pages not presently appearing on display in multi-page functions, and "zoom" in on graphic images in functions which feature graphic display capability for precision graphic editing. In the Multi Channel mode, used to specify the multi-channel AREA NO.

⑪Display key
Used to access VZ-1 graphic editing in some functions (such as DCO/DCA envelope, VIBRATO, etc.)

⑫Line key
Used to access LINE display.

⑬Internal key
Used to specify sounds in the VZ-1 internal memory (as opposed to "card" sounds - sounds stored on RAM or ROM cards).

⑭Module indicators (M1 - M8)
Indicate active sound source modules.

⑮Headphone jack
Connect headphones for "private" performance.

⑯Pitch bend wheel
Used to "bend" the overall pitch according to Bend Range values set for each patch.

⑰Definable wheel 1
Used to control a variety of VZ-1 effects.

⑱Definable wheel 2
Used to control a variety of VZ-1 effects - same as Definable wheel 1, however Definable wheel 2 is "spring loaded", and returns to the minimum value position (back) when released.

⑲Menu sub-mode keys (1-3)
Used to specify the MENU which contains the function(s) you want to access for editing, in all 4 VZ-1 operational modes.

⑳Play sub-mode key
Used to enter the PLAY (performance) sub-mode in all 4 VZ-1 operational modes.

㉑Write key
Used to write edited sounds to either internal, card or operational memories.

㉒Value slider
Used to raise or lower values of various VZ-1 parameters.

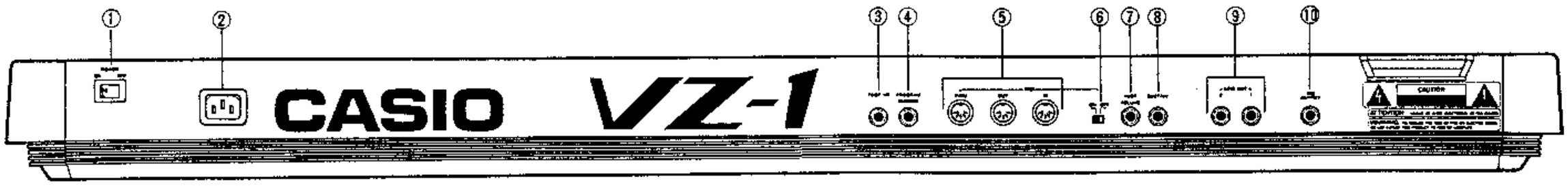
㉓Value keys
Used to raise or lower values of various VZ-1 parameters.

㉔Card key
Used to specify selection of card memory.

㉕Module selectors
(Sound number selectors 1-8)
Used to select iPD sound source modules (M1-M8) and also to specify the sound number (1-8) when selecting VZ-1 sounds.

㉖Module ON/OFF selectors (M1-M8)
(Sound bank selectors A-H)
Used to turn iPD sound source modules ON and OFF, and also to specify the sound bank (A-H) when selecting VZ-1 sounds.

REAR PANEL CONNECTIONS



①Power switch
Switches unit ON and OFF.

②Power terminal
For connection of accessory AC power cord

③Foot VR jack
For connection of "foot variable resistor" (foot pedal, VP-10, optional). Controls effects as set in MENU 2-06.

④Program number jack
Connect a foot switch (SP-10/SP-2, optional) for "hands-free" control of program number.

⑤MIDI terminals (IN/OUT/THRU)
For connection of other MIDI-equipped instruments and devices.

⑥MIDI ON/OFF switch
Switch control of MIDI ON/OFF.

⑦Foot volume jack
Connect a foot pedal for "hands-free" control of VZ-1 master volume.

⑧Sustain jack
Connect a sustain pedal (SP-10/SP-2, optional) for "hands-free" control of VZ-1 sustain.

⑨Line out jacks (1-2)
In the Combination mode or Multi-Channel mode, up to 4 patches or up to 8 areas are separated and assigned automatically into Line Out 1 or Line Out 2.

⑩Mix output jack
Mixed output of all sounds assigned to LINE OUT channels 1 through 4.

Specifications

Model:	VZ-1
Number of keys:	61 KEYS (5 OCTAVES) with TOUCH RESPONSE — INITIAL/AFTER TOUCH
Polyphonic:	16 NOTE POLYPHONIC
Sound source:	iPD (interactive phase distortion) SYSTEM
Modes:	NORMAL/COMBINATION/OPERATION MEMORY/MULTI CANNEL
Programmer:	PRESET VOICES;64/INTERNAL VOICES;64/ROM CARD VOICES;128/RAM CARD VOICES;64 PRESET OPERATIONS;64 (when system initialized) INTERNAL OPERATIONS;64/ROM CARD OPERATIONS;128/RAM CARD OPERATIONS;64 COMPARE/RECALL;5
Modules:	8 × (DCO + DCA), ON/OFF
Parameters:	INT LINE (MIX/RING/PHASE), EXT PHASE (ON/OFF), WAVE FROM:8, DETUNE (PITCH FIX, HARMONIC, POLARITY, OCT, NOTE, FINE) <DCO> ENVELOPE (STEP = 1 ~ 8, RATE = 0 ~ 99, LEVEL = −63 ~ +63, SUS, END), ENV DEPTH (RANGE = WIDE/NARROW, DEPTH = 0 ~ 63), KF LEVEL (POINT = 1 ~ 6, KEY = C0 ~ C9, LEVEL = 0 ~ 63), VEL LEVEL (SENSITIVITY = 0 ~ 31, CURVE = 1 ~ 8), VIBRATO (WAVE:4, DEPTH = 0 ~ 99, RATE = 0 ~ 99 , DELAY = 0 ~ 99, MULTI ON/OFF), OCTAVE (−2 ~ +2) <DCA> ENVELOPE (STEP = 1 ~ 8, RATE = 0 ~ 99, LEVEL = 0 ~ 99 SUS, END), ENV DEPTH (DEPTH = 0 ~ 99), KF LEVEL (POINT = 1 ~ 6, KEY = C0 ~ C9, LEVEL = 0 ~ 99), VEL LEVEL (SENSITIVITY = 0 ~ 31, CURVE = 1 ~ 8), TREMOLO (WAVE:4, DEPTH = 0 ~ 99, RATE = 0 ~ 99 DELAY = 0 ~ 99, MULTI ON/OFF), AMP SENSITIVITY (0 ~ 7), TOTAL LEVEL (0 ~ 99) <DCO/DCA> KF RATE (POINT = 1 ~ 6, KEY = C0 ~ C9, RATE = 0 ~ 99), VEL RATE (SENSITIVITY = 0 ~ 31, CURVE = 1 ~ 8, PITCH ENV STEP = ENA/DIS, AMP ENV STEP = ENA/DIS) VOICE NAME (12 characters), PARAMETER COPY, INITIALIZE
Effect:	PORTAMENTO (TIME = 0 ~ 99, MODE = 0/1), SOLO (ON/OFF), PITCH BEND (RANGE = 0 ~ 48, RELEASE = ENA/DIS), AFTER TOUCH/DEFINABLE WHEEL 1,2/FOOT VR (SENSITIVITY = 0 ~ 99, −1 ~ −99, VIB DEPTH = ON/OFF, VIB RATE = ON/OFF, PITCH = +ON/−ON/OFF, PORTAMENTO TIME = ON/OFF, TREMOLO DEPTH = ON/OFF, TREMOLO RATE = ON/OFF, AMP ENV BIAS = ON/OFF), COMBINATION LEVEL (0 ~ 99), COMBINATION PITCH (POLARITY, OCT, NOTE, FINE) SPLIT POINT (POINT = C0 ~ C9, UPPER SP = D0 ~ C9, MIDDLE SP = C♯0 ~ B8, LOWER SP = C0 ~ B♭8), SUSTAIN PEDAL = ENA/DIS, VEL SPLIT(RANGE = 1 ~ 127), VEL INVERSE = ON/OFF, POS CROSSFADE (EFFECT = ON/OFF, POSITION = C0 ~ C9, DELAY TRIGGER (DELAY = 0 ~ 99), VIB INVERSE = ON/OFF, TREMOLO INVERSE = ON/OFF, COMBINATION COPY, INITIALIZE, OPERATION NAME (12 characters), AREA PITCH (POLARITY, OCT, NOTE, FINE)
Inputs/Outputs:	line out (L2 mix) Output impedence: 0.1 kΩ Output voltage: 0.6V RMS max. headphones, foot volume, sustain, foot VR, program number, MIDI IN/OUT/THRU
Total control:	TUNE (A4 = 417.2 ~ 442 ~ 468.3Hz) TRANSPOSE (G ~ C ~ F♯) MEMORY PROTECT (INT = ON/OFF, CARD = ON/OFF) SAVE/LOAD (CARD/MIDI), MIDI CHANNEL (RECEIVE = 1 ~ 16, SEND = 1 ~ 16), MIDI DATA (PROG NO. = 0 ~ 127, EXCLUSIVE = ENA/DIS CONTROL NO. = 12 ~ 31, VOLUME IN = ENA/DIS) CARD FORMAT, PRESET CALL
Display:	64 × 96 dot matrix (with back light)
Power supply:	100V, 120V, 220V, 240V AC
Memory back up:	Built-in lithium battery (life: aprrox. 5 years)
Power consumption:	16 W
Dimensions:	1060(W) × 324(D) × 93(H) mm (41¾"(W) × 12¾"(D) × 3 11/16"(H))
Weight:	12 kg (26.5 lbs.)
Standard accessories:	AC power cord, ROM card, plug cord set, dust cover

**Design and specifications are subject to change without notice.*

GUIDELINES LAID DOWN BY FCC RULES FOR USE OF THE UNIT IN THE U.S.A. (not applicable to other areas).

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

..... reorient the receiving antenna
..... relocate the computer with respect to the receiver
..... move the computer away from the receiver
..... plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the US Government Printing Office, Washington, D.C., 20402, Stock No. 004-000-00345-4.

WARNING:
CHANGING THE VOLTAGE SELECTOR MAY REQUIRE THE USE OF A DIFFERENT LINE CORD OR ATTACHMENT PLUG, OR BOTH. TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

CASIO DIGITAL SAMPLING SYNTHESIZER

Model VZ-1 MIDI Implementation Chart

Version: 1.0

Function ...		Transmitted	Recognized	Remarks
Basic Channel	Default	1-16	1-16	Hold in memory.
	Changed	1-16	1-16	
Mode	Default	Mode 3	Mode 3	
	Messages	×	POLY/MONO	
	Altered	**********		
Note Number:		36-96	0-127	
	True voice	**********	6-127	Altered from 0~5 to 6.
Velocity	Note ON	○ 9n v = 1-127	○ 9n v = 1-127	
	Note OFF	× 9n v = 0	× 9n v = 0, 8n v = × ×	× × = irrelevant
After Touch	Key's	×	×	
	Ch's	○	○	
Pitch Bender		○	○	14 bit effective, 0~48 half tones
Control Change	1	○	○	DEF WHEEL 1
	4	○	○	FOOT VR
	5	×	○	PORTAMENTO TIME
	6, 38	×	○	DATA ENTRY
	7	○	○	MASTER VOLUME
	12~31	○	○	DEF WHEEL 2 (*1)
	64	○	○	SUSTAIN
	65	×	○	PORTAMENTO ON/OFF
	100, 101	×	○ (0)	RPC (LSB, MSB) (*2)
Prog Change:	True #	0-64, 0-127	0-127	In PLAY Mode only. 0~64 or 0~127 transmitted according to setting in MENU 3.
		**********		
System Exclusive		○	○	VOICE DATA EXCLUSIVE DATA etc.
System Common	: Song Pos	×	×	
	: Song Sel	×	×	
	: Tune	×	×	
System Real Time	: Clock	×	×	
	: Commands	×	×	
Aux Mes-sages	: Local ON/OFF	×	○	
	: All notes OFF	×	×	
	: Active Sense	×	×	
	: Reset	×	×	
Remarks		*1: One control change message transmitted as set in MENU 3. *2: RPC: Registered Program Control Number. #0: Pitch Bend Rang Parameter values set using DATA ENTRY.		

Mode 1 : OMNI ON, POLY
Mode 2 : OMNI ON, MONO
Mode 3 : OMNI OFF, POLY
Mode 4 : OMNI OFF, MONO

○ : Yes
× : No